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Performance-Based Regulation: Prospects and Limitations in Health, Safety and Environmental Protection

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ARTICLES

PERFORMANCE-BASED REGULATION: PROSPECTS AND LIMITATIONS IN HEALTH, SAFETY, AND ENVIRONMENTAL PROTECTION

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ABSTRACT

Regulation is designed to improve the performance of individual and organizational behavior in ways that reduce social harms, whether by improving industry's environmental performance, increasing the safety of transportation systems, or reducing workplace risk. Regulators can direct those they govern to improve their performance in at least two basic ways. They can prescribe exactly what actions regulated entities must take to improve their performance. Or they can incorporate the regulation's goal into the language of the rule, specifying the desired level of performance and allowing the targets of regulation to decide how to achieve that level. This second approach is the subject of this article, which summarizes the discussion at a workshop organized last year by the Regulatory Policy Program at Harvard University. The workshop brought together decision-makers from a dozen different government agencies as well as leading researchers from the fields of economics, engineering, law, and political science. The dialogue at the workshop, as summarized in this article, builds on the experiences of different regulatory agencies that have used performance-based regulation and clarifies its advantages and disadvantages in addressing health, safety, and environmental problems.

INTRODUCTION

For many people, the word "regulation" conjures up an image of detailed rules telling individuals and businesses what they can and cannot do. Yet instead of establishing specific prescriptions (or proscriptions) for behavior, regulations can also set goals for the outcome of that behavior. A performance-based regulation sets performance goals and allows individuals and firms to decide how to meet them.[1]

The idea of setting performance goals, rather than specifying behavior, dates back at least to one of the earliest-known public laws, the Hammurabi

1. *See, e.g.*, FED. AVIATION ADMIN., PERFORMANCE BASED REGULATIONS GUIDE (1998); W. KIP VISCUSI, RISK BY CHOICE: REGULATING HEALTH AND SAFETY IN THE WORKPLACE 128-29 (1983); STEPHEN BREYER, REGULATION AND ITS REFORM 105 (1982); PROJECT ON ALTERNATIVE REGULATORY APPROACHES, PERFORMANCE STANDARDS: A PRACTICAL GUIDE TO THE USE OF PERFORMANCE STANDARDS AS A REGULATORY ALTERNATIVE (1981).

Code.[2] Over the past decade, the idea of having government regulatory agencies set goals for performance has received increasing attention.[3] Interest in performance-based regulation is reflected in a number of regulatory developments and initiatives. For example, Executive Order No. 12866, issued by President Clinton and retained by President Bush, directs agencies wherever feasible to specify performance objectives, rather than behavior, in crafting new regulations.[4] In addition, several regulatory agencies, such as the Environmental Protection Agency and the Federal Highway Administration, have experimented with initiatives for creating alternative regulatory requirements for firms that demonstrate a superior level of performance.[5] The Nuclear Regulatory Commission and the Department of Transportation's Office of Pipeline Safety have initiated risk-informed, performance-based approaches to achieving their safety regulatory goals.[6] These and other agency efforts to focus on performance are premised on a desire to achieve the same results as other standards, while giving firms the flexibility to achieve those results in a cost-effective manner.

Despite growing interest in the performance of government regulation,

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2. CODE OF HAMMURABI 112 (L.W. King trans.), *available at* http://www.yale.edu/lawweb/avalon/medieval/hamframe.htm. The Code specifies, among other things, that a builder of a house "must make the walls solid" and of a ship must "make it tight." *See also* Greg C. Foliente, *Developments in Performance-Based Building Codes and Standards*, 50 FOREST PRODS. J. 12, 13 (2000) (noting the performance-based building standards in the Hammurabi Code).

3. *See* Steven Kelman, *Public Management: The Power of Performance Measures*, GOVT. EXEC. MAG., June 1, 2001, *at* http://www.govexec.com/features/0601/0601pubmanage.htm. This emphasis on setting performance has been formalized in the Government Performance and Results Act of 1993, 5 U.S.C. § 306 (2000); 31 U.S.C. §§ 1105(a)(29), 1115-19, 3515(a), 9703-04 (2000); 39 U.S.C. §§ 2801-05 (2000) [hereinafter GPRA].

4. Exec. Order No. 12,866, § 1(b)(8), 58 Fed. Reg. 51,735 (Oct. 4, 1993) (directing federal agencies to develop a more efficient regulatory scheme by adopting performance-based standards).

5. The Environmental Protection Agency has established a variety of initiatives over the past decade that are focused on recognizing firms that achieve superior levels of environmental performance, including Project XL and the National Environmental Performance Track. *See, e.g.*, ALFRED A. MARCUS ET AL., REINVENTING ENVIRONMENTAL REGULATION: LESSONS FROM PROJECT XL (2002) (describing Project XL); Dennis D. Hirsch, *Second Generation Policy and the New Economy*, 29 CAP. U. L. REV. 1, 13-14 (2001) (describing EPA's Performance Track program). In the late 1990s, the Federal Highway Administration created a pilot project to create a more flexible, performance-focused regulatory environment for "exemplary" motor carriers. *See* Motor carrier Regulatory Relief and Safety Demonstration Project, 63 Fed. Reg. 37,619 (July 13, 1998).

6. *See* Nuclear Regulatory Commission, High-Level Guidelines for Performance-Based Activities (2000), *at* http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2000/secy2000-0191/2000-0191scy.html; Nuclear Regulatory Commission, Guidance for Performance-Based Regulation (2002), *at* http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0303/index.html (describing high level principles for NRC's performance-based approach); Office of Pipeline Safety: Pipeline Integrity Management in High Consequence Areas, 67 Fed. Reg. 2,136, 2,140 (Jan. 16, 2002) (indicating that new regulation issued by the Office of Pipeline Safety, a part of RSPA, was "written using a performance-based approach").

researchers have yet to subject performance-based standards to close empirical scrutiny. There has been relatively little study of how performance-based regulation works in practice across different regulatory settings. Moreover, in many areas of regulation, the use of performance-based standards has remained less frequent than might be expected. Many regulatory standards still specify particular behaviors, technologies, procedures, or processes rather than setting a performance target and allowing firms the flexibility to achieve that goal.[7]

There may be good reasons why government regulators do not rely more extensively on performance targets. Performance-based standards depend on the ability of government agencies to specify, measure, and monitor performance, but reliable and appropriate information about performance may sometimes be difficult if not impossible to obtain.[8] When implemented in the wrong way, or under the wrong conditions, performance-based regulation will function poorly, as will any regulatory instrument that is ineffectually deployed.

What is the role, then, for performance-based standards in the regulator's toolbox? Once it is determined that some form of government regulation is needed to solve a particular problem, what are the conditions under which a performance-based standard is the appropriate regulatory instrument? What particular challenges can be expected to arise in implementing performance-based regulation?

These questions framed the discussion that took place at the Regulatory Policy Program's workshop on performance-based regulation last year. This article, summarizing that discussion, is organized around four major themes that emerged during the workshop:

- Defining Performance-Based Regulation
- Conditions for Performance-Based Regulation
- Information and Uncertainty
- Implementing Performance-Based Regulation

I. DEFINING PERFORMANCE-BASED REGULATION

Performance can be integrated into the mission and activities of regulatory agencies in four principal ways. Specifically, a regulatory system that is performance-based can be thought of as one in which

7. *See* W. Kip Viscusi & Ted Gayer, *Safety at Any Price?*, 25 REGULATION 54, 55, 60 (2002) (describing conventional tendency toward technology standards).

8. *See* BREYER, *supra* note 1, at 105 (noting that "performance standards are often difficult to enforce" because of the challenges associated with developing appropriate tests of performance).

performance is used as:

1. the basis for the legal commands found in regulatory standards,
2. a criterion for allocating enforcement and compliance resources,
3. a trigger for the application of differentiated (or tiered) regulatory standards, and
4. a basis for evaluating regulatory programs and agencies.[9]

The first of these conceptions—namely performance standards—is probably the most common in the literature on policy instrument choice, but other notions of performance-based regulation also frequently arise in policy and academic discourse. To analyze the potential and limitations of performance-based regulation, it is important to be clear about what one means by this approach to improving regulation. The workshop discussion summarized in this article focused on the first of the above concepts: performance standards, or using performance as the basis for the legal commands found in government regulations.

At the workshop, there was general agreement on a basic definition of performance standards. A performance standard specifies the outcome required, but leaves the specific measures to achieve that outcome up to the discretion of the regulated entity.[10] In contrast to a design standard or a technology-based standard that specifies exactly how to achieve compliance, a performance standard sets a goal and lets each regulated entity decide how to meet it.

Participants offered several refinements to this general definition, identifying different ways that performance-based standards can be distinguished. These distinctions were based on (1) the precision of the regulation; (2) the underlying basis for the threshold reflected in the performance standard; (3) the scope of the regulation's ultimate objective and the location of the rule in the causal chain of events leading to that ultimate objective; and (4) the type of problem the standard aims to solve.

With respect to the precision of the regulations, performance standards can be either loosely or tightly specified.[11] For example, a loosely

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9. For amplifications and illustrations of these four conceptions of performance-based regulation, see Cary Coglianese et al., Performance and Regulation: A Conceptual Overview (2002) (unpublished manuscript, on file with authors), *available at* http://ksghome.harvard.edu/~.CCoglianese.Academic.Ksg/PBRconceptualover-view.pdf.

10. *See* NEIL GUNNINGHAM & RICHARD JOHNSTONE, REGULATING WORKPLACE SAFETY: SYSTEMS AND SANCTIONS 23 (1999) (defining a performance standard as "a standard [that] specifies the outcome of the . . . improvement but which leaves the concrete measure to achieve this end open for the [regulated entity] to adapt to varying local circumstances").

11. For discussion of the precision of legal rules, see Colin Diver, *The Optimal Precision of Administrative Rules*, 93 YALE L.J. 65, 65-66 (1983).

specified performance standard could require that vegetation adjacent to railroad track be controlled so that it "does not become a fire hazard or obstruct visibility." Such a regulation provides less guidance to the railroad (and gives more discretion to both the railroad and the regulator) than does a tightly specified regulation requiring that vegetation be controlled so that it "remains at least three feet away" from railroad track. Most loosely specified standards call for regulators to make qualitative judgments, while many tightly specified standards employ quantitative measures of performance.[12]

Performance standards can also be distinguished according to how levels of performance are determined. One participant distinguished quantitative standards that are based on predictions (e.g., computer simulations of nuclear power plants) from those that are based on actual measurements (e.g., smoke-stack emissions measured with a continuous monitoring device). Another participant distinguished between (a) performance standards that are based on a determination of the appropriate level of risk and (b) standards set according to the level of performance that is achievable or feasible using known technologies.

Performance-based standards also differ based on the distance between their performance targets and the ultimate objective that motivated the decision to develop a regulation. One workshop participant coined the term "trans-performance standards" to refer to standards that focus on an ultimate societal objective, such as water quality, rather than more narrow objectives, such as effluent limits.[13] On a related note, participants noted that the amount of flexibility embodied in a given standard can only be understood in reference to the ultimate goal of the standard. A performance standard that simply codifies a broad societal objective (such as preventing injuries from airplane crashes) will undoubtedly allow firms substantial discretion. In contrast, a regulation that specifies a narrower or subsidiary goal (such as requiring that aircraft have sufficient engine power to reach cruising altitudes quickly) allows firms less discretion in how they will meet the ultimate objective.

Finally, performance standards can be distinguished based on the types of problems they are designed to solve. Key characteristics of problems include the severity and likelihood (or frequency) of the problems, as well as the number of regulated entities and other affected individuals or groups. For example, standards that deal with high-consequence, low-probability

12. Professor Kip Viscusi has argued that whenever possible, performance standards should be specified in quantitative terms. VISCUSI, *supra* note 1, at 130.

13. For a similar distinction in the context of occupational safety and health regulation, see *id.* at 129 (distinguishing between standards governing "particular workplace conditions" and "the extreme case" of a performance standard that uses workplace injuries or fatalities as the basis of the standard).

events (e.g., a meltdown of a nuclear power plant or a pipeline explosion) are likely to differ in important ways from standards that deal with low-consequence, high-probability events (e.g., food-borne illnesses or traffic infractions).

In light of these various ways to distinguish among performance standards, several participants noted the need to develop a more refined taxonomy of performance standards to avoid confusion and facilitate better decision-making. An important step for future research will be to develop a clearer conceptualization of the different types of performance standards.

II. CONDITIONS FOR PERFORMANCE-BASED REGULATION

There is surely no single answer to the question of whether regulatory agencies should use performance-based regulation. That is, performance-based regulation is not a "magic bullet" or "one size fits all" approach applicable to all situations, especially given the numerous conceptual differences among performance standards outlined in the previous section.[14] In determining whether to use a performance standard, and if so, the specific type of standard to adopt (e.g., loosely vs. tightly specified), decision-makers need to consider the conditions under which the standard will be applied.

Participants discussed several general considerations about the strengths and weaknesses of performance standards. By focusing on outcomes, for example, performance standards give firms flexibility and make it possible for them to seek the lowest-cost means to achieve the stated level of performance.[15] Performance standards can also accommodate technological change and the emergence of new hazards in ways that prescriptive technology-based standards generally cannot.[16] However, performance-based standards can sometimes be imprecise, especially when the standards are loosely specified. In addition, in some contexts, measuring performance presents distinct challenges, such as when the standards are based on predictions rather than actual measurable events.

Several participants noted that even these general claims about the advantages and disadvantages of performance-based regulation need to be assessed concretely, within the context of specific regulatory problems and possible alternative standards. After all, performance-based standards may be defined very narrowly, for example, by specifying the performance of a

14. *Id.* (noting that "it is an oversimplification to claim that [performance standards] are always preferable").

15. *See id.* at 130-31 ("The central advantage of performance standards is that the firm has the opportunity to select the least costly means of compliance.").

16. *See* BREYER, *supra* note 1, at 105 ("A performance standard permits flexibility and change.").

pump in an industrial process. In such cases, they may actually offer little discretion to regulated entities.[17] Even when performance standards are broadly defined, for example, requiring an overall level of safety at nuclear power plants, they may require strict adherence to highly specified and prescriptive modeling methodologies that could bring back many of the shortcomings of a prescriptive approach, especially if a firm's computer simulation itself must be approved by the regulator. In cases such as these, the regulated entities' discretion may be significantly constrained even with a performance standard.

Similarly, participants noted that performance-based regulations may impose excessive costs on business, particularly small firms, because firms must search for ways to meet regulatory standards. Some firms may simply prefer to be told exactly what to do, rather than incur costs to identify steps needed to achieve a performance standard. In some settings, non-binding codes of practice have been developed by government, trade associations, or standards organizations to provide guidance to firms that lack the resources to determine how to meet regulatory requirements on their own. But such codes of practice sometimes effectively take the form of prescriptive standards that performance standards are supposed to replace.[18]

Several participants noted that performance standards may be used to address a variety of risks, from repeated and expected harms such as emissions of industrial pollution, to rare and catastrophic events such as fires, oil tanker spills, or nuclear power plant accidents. These participants argued that performance standards present fewer implementation issues in cases where actual performance can be evaluated and verified. For example, when direct and continuous monitoring of smokestack emissions is possible, performance can be clearly verified. In contrast, performance cannot be directly measured for rare and catastrophic events, and instead must be predicted, making implementation more difficult.[19]

In deciding which type of regulatory instrument to use, regulators will want to consider the risk of making a mistake. Since the consequences of regulatory failure in the areas of airline safety or the operation of nuclear

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17. *Id.* (noting that sometimes regulators "write performance specifications that could be met only by a machine of a certain design").

18. *See* EUGENE BARDACH & ROBERT A. KAGAN, GOING BY THE BOOK: THE PROBLEM OF REGULATORY UNREASONABLENESS 236-37 (1982) (pointing out that in some cases even technically non-binding "government 'guidelines' come to be treated as binding rules").

19. *See* Kathy Notarianni & Paul S. Fischbeck, *Performance with Uncertainty: A Process for Implementing Performance-Based Fire Regulations*, *in* IMPROVING REGULATION: CASES IN ENVIRONMENT, HEALTH, AND SAFETY 233, 239 (Paul S. Fischbeck & R. Scott Farrow eds., 2001) (noting how the complexity of the computer modeling required with predicting performance may make it more difficult to implement performance standards than so-called prescriptive standards).

reactors will typically be more pronounced than in the areas of landfill operations or consumer products, the nature and extent of these consequences may affect the desirability of performance standards versus design standards. For example, design standards might be preferred when there is high risk and existing technologies are known to work well.

While it is often useful for conceptual purposes to distinguish performance standards from design standards, participants acknowledged that in practice the two approaches can be better thought of as end points along a spectrum of regulatory approaches.[20] In other words, when setting standards, regulatory agencies usually select a point on a spectrum running from what might be considered "pure" performance standards to "pure" design standards, depending on the level of discretion afforded the targets of regulation.

Although several participants suggested that performance-based standards are probably preferable to design standards in the vast majority of situations, these and other participants recognized that there is little empirical evidence to support this claim. Indeed, many participants acknowledged that there is a dearth of empirical studies aimed at measuring the effectiveness of performance-based standards, especially in comparison with the effectiveness of other regulatory instruments.[21]

Several participants suggested that, for many purposes, regulators need to choose hybrid approaches that may minimize some of the weaknesses of both design and performance standards. In other words, regulators do not have to choose between these two types of standards but in many cases can use a blend of instruments. One approach is to require specific technologies or designs, but to add to the regulation so-called equivalency clauses or provisions for alternative compliance mechanisms. These provisions effectively allow firms to "opt-out" of the prescriptive standard if they can demonstrate that they can achieve a comparable level of performance through other means.

In addition, most regulatory systems probably include a combination of various types of standards, as well as elements of tiered regulations,

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20. *See* GUNNINGHAM & JOHNSTONE, *supra* note 10, at 23 (arguing that "specification" standards and "performance" standards are "polar extremes on a continuum" and that any "real world standard can be located on the continuum somewhere between the two poles"); *see also* PROJECT ON ALTERNATIVE REGULATORY APPROACHES, *supra* note 1, at 1 ("In practice, the distinction between performance standards and design standards is better characterized as a continuum than a simple dichotomy.").

21. At the conference, we asked participants if they could point us toward any systematic empirical studies that compared performance standards with design or technology standards. In addition, we conducted extensive searches in the academic literature, asked colleagues who were not at the conference, and solicited input via a global Internet listserv devoted to regulatory policy. In the end, we were unable to locate any systematic empirical study evaluating the impact of performance standards relative to other regulatory approaches.

equivalency clauses, alternative compliance mechanisms, and codes of practice. In other words, any given regulatory response to a policy problem may include both a mandate for use of a particular design as well as performance thresholds. For example, to ensure passenger safety in trains, the Federal Railroad Administration has mandated that train cars be built using a crash energy management design so that portions of cars absorb some of the impact of a crash, but it has also established a performance-based standard for how much of the impact must be absorbed in crash tests.[22] In other cases, regulators set performance goals but provide design- or technology-based guidance in the form of codes of practice.

Participants generally agreed that all types of regulatory instruments have a role to play, depending on the situation at hand. The challenge for decision-makers and researchers is to identify the conditions under which different tools are appropriate, while also keeping an eye on changing conditions or new alternatives. Many of the important criteria to consider when selecting the appropriate regulatory tools emerged from the workshop discussion, including effectiveness, efficiency, equity, clarity, and the ease and accuracy of enforcement.

III. INFORMATION AND UNCERTAINTY

Performance-based regulation raises a number of issues relating to uncertainty, information, and the role of experts in regulatory decision-making. Perhaps the biggest uncertainty is the performance of performance-based standards. Participants noted a general absence of empirical studies evaluating the effectiveness of performance-based standards, let alone systematic work showing when, where, and how well performance-based standards work in various regulatory settings.

Participants noted that loosely specified performance-based standards, by definition, create uncertainty for both regulators and regulated entities with respect to enforcement and compliance issues. Moreover, regulators who are accustomed to enforcing relatively straightforward prescriptive standards are frequently uncomfortable with the discretion inherent in loosely specified performance-based standards. Some participants speculated that it may take years (if not a generation or more) for regulators to become accustomed to new discretion, though some participants argued that regulators with more professional training (or higher levels of education) might adapt more quickly. Participants also noted that regulated entities may be uncomfortable with loosely specified performance standards because they believe such standards give regulators too much

22. Crash Energy Management, 49 C.F.R. § 238.403 (2002).

discretion when deciding enforcement issues.[23]

Participants acknowledged that even tightly specified performance standards, including ones that specify quantitative thresholds for performance, can raise at least two sets of issues related to uncertainty. First, setting optimal quantitative thresholds requires a detailed understanding of the dose-response relationships among the precursors and the ultimate objective. For example, setting optimal emissions thresholds requires an understanding of the relationship between emissions and human health outcomes. In practice, however, these dose-response relationships are sometimes poorly understood, thereby making it difficult to determine the optimal thresholds.

Second, many participants agreed that performance-based standards work well when actual performance can be measured, evaluated, and verified. However, considerable uncertainty arises when this is not the case. In that situation, simulation models are frequently used to make predictions, but these models can have distinct limitations. For example, the factors contributing to a rare event can be extremely numerous, leading to a high level of model complexity. Since it is generally impossible to simulate every potential scenario, predictions are necessarily limited in scope. Moreover, constructing and using such models requires making value judgments, such as determining what is an acceptable threshold for temperature in a burning building.[24] The models also require assumptions about the processes underlying performance, such as how people will react when they hear a fire alarm. Participants also noted that many types of uncertainties often go unrecognized or ignored.

Furthermore, the limitations of predictive models are frequently not well understood, so researchers sometimes may not even know what may be missing from their analysis. These and other limitations increase uncertainty when actual performance cannot be easily evaluated or verified.[25] Moreover, such verification problems are not limited to rare, high-consequence events, such as fires or nuclear melt-downs, but can arise in any situation where performance cannot be measured reliably.

One participant voiced concern that performance standards based on

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23. *See* John Braithwaite et al., *Raising the Standard: Resident Centered Nursing Home Regulation in Australia* 10 (Aged and Community Care Service Development and Evaluation Reports No. 10, 1993) (noting that businesses like certainty and that design or technology standards can provide greater certainty and guidance); VISCUSI, *supra* note 1, at 129 (arguing that if performance standards are not specified precisely "the result may be capricious enforcement creating so much uncertainty that firms will forgo making improvements until after they are inspected and penalized").

24. *See* Notarianni & Fischbeck, *supra* note 19, at 254.

25. For a discussion of how to analyze uncertainty when it does arise in policymaking, see M. GRANGER MORGAN & MAX HENRION, UNCERTAINTY: A GUIDE TO DEALING WITH UNCERTAINTY IN QUANTITATIVE RISK AND POLICY ANALYSIS 172-216 (1990).

predictive models could lead to "legitimate self-delusion" on the part of regulated entities. In other words, regulated entities may present or interpret their models and data in a way that makes it look as if their proposed approaches will perform well, when in fact a more disinterested examination would reveal problems with the analysis.[26]

Nevertheless, several participants noted that considerable progress has been made in recent years in developing tools to quantify risk. They mentioned that probabilistic risk assessment, for example, is one tool that pulls together all of the elements of risk.[27] Some participants cautioned that these new tools require large amounts of data to run successfully; however, others noted that such tools are most valuable when little data is available. After all, agencies have to deal with uncertainty in any case, whether or not they use a formal risk assessment methodology to inform their decision. Probabilistic risk assessment simply offers a systematic approach to addressing uncertainty.

Several participants noted that a prescriptive approach to standard setting can sometimes be a "fig leaf" hiding underlying uncertainties, since the actual performance level inherent in prescriptive standards may be unknown and even at times unexamined. Perhaps this is why, as one participant suggested, the decision to consider using performance standards can offer benefits simply in terms of "shaking things up" or focusing the policy dialogue on the ultimate objectives and the underlying uncertainties. Performance-based regulation may demand more explicit attention to goals and uncertainties, and this attention can be valuable regardless of the specific regulatory instrument selected.

The key is to use all of the available evidence at hand: statistical, laboratory, and expert judgment. Participants suggested that a systematic approach to this evidence can help focus decision-making on the important issues. However, other participants noted that quantification of uncertainty might sometimes fail to make decision-making any easier because even after using predictive models, policymakers must still decide how much

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26. Humans have a tendency to interpret data in a light favorable to their own interest. For a recent discussion of the effects of this self-serving bias in another context, see Max H. Bazerman et al., *Why Good Accountants Do Bad Audits*, 80 HARV. BUS. REV. 3, 3-8 (2002).

27. Risk assessment is a systematic method for determining the probability and consequences of an undesirable occurrence, such as an accident or fatality. NAT'L RESEARCH COUNCIL, SCIENCE AND JUDGMENT IN RISK ASSESSMENT 4 (1994). Probabilistic risk assessment, a term used widely in the area of nuclear safety regulation, involves defining and characterizing undesirable occurrences, identifying their potential causes, calculating the probability for each occurrence, and ranking or weighting the various occurrences according to the likelihood (and consequence) of their occurring. *See generally* Vicki M. Bier, *An Overview of Probabilistic Risk Analysis for Complex Engineered Systems*, *in* FUNDAMENTALS OF RISK ANALYSIS AND RISK MANAGEMENT 67 (Vlosta Molak ed., 1997); *see also* Vicki M. Bier et al., *A Survey of Approaches for Assessing and Managing the Risk of Extremes*, 19 RISK ANALYSIS 1, 83 (1999).

safety to require.

Participants raised several general concerns about uncertainty, applicable both to loosely specified and tightly specified performance standards. One participant noted that uncertainty can arise from changing circumstances. For example, a building may change from its originally intended use or it may deteriorate, and these changes could affect the performance of fire-suppression devices that were originally predicted to be safe, based on the initial conditions.[28] Uncertainty can also be introduced simply in the process of drafting regulations. That is, even assuming that all the affected parties understand and agree with the spirit of a given regulation, it is often difficult to find the exact words to capture that spirit without leaving room for interpretation or manipulation, and thereby creating uncertainty.

Participants also discussed the issue of who "owns" the uncertainty. There are many actors involved in the regulatory process, so it is important to consider who gains and who loses as a result of uncertainty, as well as whose responsibility it is to try to reduce that uncertainty. Should it be the responsibility of federal agencies, the states, standard-setting organizations, industry, or some combination of these different entities? Whose goals and values are served by focusing on the uncertainty? Who controls the estimation, choice of data, and safety margins? Put differently, is the regulatory framework one of "innocent until proven guilty," under which government must wait until a danger is obvious before taking action? How much uncertainty should be tolerated?

Participants made several points about the information needed to address these and other questions. Early in the workshop, participants noted that greater use and increased understanding of performance standards requires better systems to collect and analyze data on performance.[29] Others added that it is critical to consider who is going to collect the data, how often, what the data will be used for, as well as what the incentives may be to cheat and what can be done about them.

Without reliable data, debates about the role of performance standards will continue to be limited largely to anecdotes. In light of the absence of empirical evaluations of performance-based standards, one participant suggested using an adaptive learning or a learn-as-you-go approach. Given some of the perceived limitations of predictive models, a participant raised a further question about whether we should invest limited resources in developing better models, or in gathering empirical data about the effects

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28. Notarianni & Fischbeck, *supra* note 19, at 236 (noting that "many factors change over the lifetime of a building," including "future use, occupancy, and other factors").

29. *See generally* SHELLEY METZENBAUM, MAKING MEASUREMENT MATTER: THE CHALLENGE AND PROMISE OF BUILDING A PERFORMANCE-FOCUSED ENVIRONMENTAL PROTECTION SYSTEM (The Brookings Inst. Ctr. For Pub. Mgmt., CPM Report 98-2, 1998).

of performance-based standards.

One participant argued that even though an advantage of performance-based regulation is that it can decentralize governance by giving firms greater flexibility, the government must still monitor each firm's performance, and thus may be required to get so involved that it is "essentially running everything again." In some cases, the information requirements for either a good performance standard or a good prescriptive standard may be so demanding that these two approaches could be very similar in terms of what the government needs to know.

Some participants noted an inconsistency between the Government Performance and Results Act,[30] which requires agencies to evaluate their own performance, and the Paperwork Reduction Act,[31] which makes it more difficult for agencies to gather information. Transitioning to a performance-based regime requires that the government collect from industry new and better data on performance and performance indicators, but the Paperwork Reduction Act tends to constrain agencies from collecting precisely the kind of data that may be needed.

Participants also discussed the role of experts in policymaking and the importance of communicating information about performance and uncertainty to the public. Several participants expressed concern about relying on complex, predictive models of performance. They suggested that many people lack the training to use or understand these models. As a result, the number of people who can knowledgably participate in regulatory decision-making declines as the complexity of the analysis increases, thereby causing the government either to rely on third-party experts (e.g., academics or consultants) to do much of the analysis, or to accept too readily the analysis provided by the regulated entities. In such cases, policymaking might be unduly influenced by non-governmental actors, with an insufficient check on the "legitimate self-delusion" of regulated entities.

Regardless of who conducts the analysis or the complexity of the results, several participants argued that the information underlying performance-based regulation should be communicated in a way that is understandable to the public. The public's perception of risk, it was noted, may be quite different from the perceptions of government officials or industry representatives.[32] Effective communication about risk, uncertainty, and performance puts information into the hands of those ultimately affected by

30. GPRA, *supra* note 3.
31. 44 U.S.C. §§ 3501-20 (2000).
32. *See* Nancy Kraus et al., *Intuitive Toxicology: Expert and Lay Judgments of Chemical Risks*, 12 RISK ANALYSIS 2, 215-31 (1992).

regulatory policy and therefore promotes democratic values.[33]

IV. IMPLEMENTING PERFORMANCE-BASED REGULATION

Implementing performance-based regulation poses its own challenges, especially when a government agency needs to make a transition from a regime based heavily on design- or technology-based standards. As noted earlier, participants acknowledged a lack of empirical research on the best practices for implementing performance-based regulation.[34] One participant claimed that although there is a great deal of potential evidence in the form of existing regulatory programs, gathering and analyzing it will require substantial effort. Another participant suggested the need for a "Consumer Reports" type of metric to be used to evaluate how well performance-based and other regulations perform across different agencies. Before such research proceeds, however, some participants recommended that a better conceptual taxonomy of performance-based regulation be developed to facilitate research and analysis.

Several participants noted agency and industry resistance to performance-based regulation. Some regulators, for example, resist moving from prescriptive regulations, with which they are comfortable, to performance-based regulations, which they consider ambiguous. These regulators find it especially difficult to make the transition from hardware-oriented checklist inspections to inspections that call for them to judge the quality and effectiveness of a facility's performance.[35] Even though industry generally prefers the flexibility inherent in performance-based regulation, many firms are anxious to avoid the ambiguity (and associated increase in regulators' discretion) that sometimes accompanies performance-based regulation.

Although there seems to be some movement toward performance-based regulation within certain agencies, some participants found the progress to be slow and limited. Participants noted at least three factors inhibiting the transition to performance-based regulation, including (1) regulators' comfort with the existing prescriptive approach, (2) measurement problems, and (3) institutional path dependence due to existing legislation oriented toward a design-based approach. One participant noted that it was difficult to embed a new performance-based approach within a "design-based world." Another participant described his efforts to superimpose

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33. *See* NAT'L RESEARCH COUNCIL, IMPROVING RISK COMMUNICATION 10 (National Academy Press 1989).

34. *See supra* text accompanying note 21.

35. *See* MALCOLM SPARROW, THE REGULATORY CRAFT: CONTROLLING RISKS, SOLVING PROBLEMS, AND MANAGING COMPLIANCE, 109-22 (2000) (noting the difficulty with changing the focus of regulatory agencies, including enforcement staffs).

performance-based standards onto the existing regulatory system as "humbling," likening the process to making a change in the design of a skyscraper after construction had already been completed.

A number of agency administrators who would like their organizations to be results-driven wondered about strategies that could be used to accelerate the application of performance-based approaches in systems that were not designed for that purpose. How does the government adapt its regulatory institutions to a performance-based approach? Are the transition costs worth the benefits?

In response to these questions, several participants suggested that it may take considerable time—possibly a generation—to make the transition to a fully performance-based regime. Some suggested that regulatory regimes do not change on their own; rather, it is the ability of regulatory decision-makers to acknowledge and absorb uncertainty that changes. It is important to learn how to build mechanisms that will allow for learning about, and fostering comfort with, new approaches to regulation. This evolutionary process necessarily takes time, and so it is important to adopt a long-term outlook.

Several factors were mentioned that might affect the speed of the transition to performance-based regulation at different agencies. These factors included: (1) the credibility of the regulators (e.g., several participants noted that major accidents leading to political fallout will delay any transition), (2) the readiness of the agency to embrace change (measured perhaps as a function of training budgets and workforce demographics such as age, education, and level of tenure), and (3) the economic environment (since there is, as one participant noted, an inverse relationship between safety and cost). One participant also noted that, in a different context, the transition to performance-based approaches in procurement has faced similar obstacles (e.g., cultural inertia reflected by statements such as "we've never done it that way before").[36]

One participant argued that performance-based regulations may engender adverse, unintended behaviors. In other words, the flexibility that performance-based standards provide to firms may be used in ways that cause undesirable side effects, even if the firms still meet the performance goal. Therefore, letting industry choose its own path always presents the possibility of generating new or even larger risks. In contrast, design-based standards provide clear direction to regulated entities and agency

36. For a discussion of challenges in the area of government contracting, see STEVEN KELMAN, PROCUREMENT AND PUBLIC MANAGEMENT: THE FEAR OF DISCRETION AND THE QUALITY OF GOVERNMENT PERFORMANCE (1990); Steven Kelman, *Strategic Contracting Management*, *in* MARKET BASED GOVERNANCE: SUPPLY SIDE, DEMAND SIDE, UPSIDE AND DOWNSIDE 88-100 (John D. Donahue & Joseph S. Nye, Jr. eds., 2002).

enforcement staff, an approach which may be satisfactory even if not, strictly speaking, optimal.[37]

Several participants argued that making the transition to a performance-based system also requires changing the prevailing approach to enforcement. Instead of simply determining whether a firm has installed mandated technologies or otherwise achieved compliance, performance-based regulation may often require the application of performance indicators so that agencies can intervene before an undesirable event occurs. For example, the number of times that a nuclear power plant shuts down annually may be one such performance indicator, since shutdowns do not by themselves present a safety risk even though they do indicate that a plant may be having problems. Some participants pointed out that performance indicators should be embedded well below the level of the ultimate objective to give regulators enough time to prevent bad performance. For example, one agency developed performance indicators using probabilistic risk assessment. The agency now assigns risk levels to each firm based on periodic reviews of the firm's performance indicators. If a firm receives two consecutive "risky" ratings, it is asked to propose corrections. The agency progressively takes more control of facilities with higher risk levels.

Many participants noted that it is important to develop adequate performance measures or indicators. Ideally, such measures or indicators would allow meaningful comparison of performance trends among firms. However, this is often difficult to accomplish in practice. For example, the impact of industry decisions and process improvements on performance is not always immediate, sometimes taking years to manifest—especially when the outcome of concern is a low-probability event, such as a nuclear power plant accident. Moreover, in complex systems, it is often hard to assess the impact of a specific change on a specific outcome because there may be many changes occurring simultaneously.[38] In such situations, meaningful performance measures or indicators may be difficult to define.

Some participants noted that performance-based standards (like design standards) do not offer firms any incentive to go beyond compliance. To encourage continuous improvement, participants suggested that the government offer incentives to prod businesses into using their creative talents to develop more effective and efficient solutions. For example, in addition to setting a performance-based goal, the government could charge

37. *See* BREYER, *supra* note 1, at 105-6 (noting tradeoff between flexibility and enforceability in choosing between performance and design standards).

38. For a discussion of the relationship between complexity and accident outcomes, see CHARLES PERROW, NORMAL ACCIDENTS: LIVING WITH HIGH-RISK TECHNOLOGIES 62-100 (1984).

a fee for behaviors that increase risk. This is one of the advantages of so-called market-based or incentive-based regulation. When firms are expected to pay an emissions or safety tax, or if they are allowed to trade emissions credits, some of them will reduce their risks to levels lower than they otherwise would have, achieving a more cost-effective overall level of risk reduction.[39]

Participants noted that all of the issues related to uncertainty described earlier in this article make implementing performance-based regulation difficult. One participant suggested that the uncertainty associated with performance-based regulation may actually make it more difficult to conduct economic analysis of performance standards, in a sense making it harder for agencies to adopt an approach that should result in lower costs. One participant also suggested that the Office of Management and Budget's review process should take into account the different kinds of information needed to assess performance standards, as opposed to standards that specify the use of known technologies.

Many participants commented on the importance of dialogue among key stakeholders when making the transition to a performance-based approach. For example, many agreed that dialogue between government and industry is important in developing performance-based standards. By engaging with business, for example, the government can learn how difficult it may be for small firms to respond to performance-based rules and that such firms may prefer being told exactly what to do.[40] Dialogue also can be used to educate and inform stakeholders about performance-based regulation, thereby making them more comfortable with the transition. Participants also mentioned that dialogue may help expand the set of possibilities available to regulators, as well as lead to the creation of industry-wide yardsticks for assessing performance.

Even if dialogue does not result in a new rule, or change an existing rule, one participant argued that the process can help the regulated community

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39. *See* Cary Coglianese & David Lazer, *Management-Based Regulation: Prescribing Private Management to Achieve Public Goals*, 37 LAW & SOC'Y. REV. 691, 701 (2003) ("[R]egulators enforcing market-based regulation still measure firms' performance for the purpose of either assessing taxes or determining if firms possess an adequate number of tradeable permits."); VISCUSI, *supra* note 1, at 129 ("The best-known performance standard in existence is the EPA 'bubble policy,' which relaxes the pollution standards for each emissions point and imposes instead an overall requirement on emissions leaving a hypothetical bubble over the plant."). For an overview of market-based instruments in the area of environmental protection, see Robert N. Stavins, *Market-Based Environmental Policies: What Can We Learn From U.S. Experience (and Related Research)?* (Res. for the Future, Discussion Paper 03-43 2003), *available at* http://www.rff.org/rff/Documents/RFF-DP-03-43.pdf.

40. *See* GUNNINGHAM & JOHNSTONE, *supra* note 10, at 31 (noting that small firms "lack the skills, knowledge, or sophistication to devise their own least costs solutions to [regulatory] problems" and therefore "require technical information and detailed practical guidance").

focus on why a problem is a concern and may help lead to change over time. Another participant noted concern that not everyone affected by a regulation will participate in the dialogue, though others suggested that some dialogue is still probably better than none. Finally, participants pointed out that performance data and careful program evaluation will be necessary to inform both dialogue and agency decision-making.

CONCLUSION

Expanding the use of performance-based regulation holds promise for achieving health, safety, and environmental goals at a lower cost and for doing so in a way that accommodates if not encourages technological innovation. Yet the advantages of performance-based regulation do not necessarily mean that it is always the best regulatory strategy. Effective performance-based regulation depends ultimately on a thorough understanding of the nature of the problem that calls for government intervention, including a clear account of the causes of and contributors to that problem. In choosing a regulatory instrument to address a particular problem, it will be useful to keep in mind that performance-based regulation is but one of several choices. Moreover, as many workshop participants noted, performance standards themselves differ in their specificity, measurability, and feasibility.

Performance standards will be appropriate in some, and perhaps even many, regulatory contexts. Some other situations will call for a hybrid approach that either combines performance standards with design standards (or codes of practice) or combines design standards with performance-based equivalency clauses. Regardless of which options regulators consider, they will confront some level of uncertainty. Performance-based options may even draw greater attention to this uncertainty. As with any decision-making, of course, addressing uncertainty calls for a careful analysis of all the available evidence, as well as effective communication of this evidence to decision-makers and the various affected parties.

Participants suggested that expanding the use of performance-based regulation to new areas, even when appropriate, may prove difficult because of resistance from those who are comfortable with the status quo. Participants noted that in some cases a lack of data on performance, or on performance-based standards, may contribute to the difficulties associated

with implementing performance-based regulation. Many participants also stressed the importance of further efforts to develop an informed dialogue about performance-based regulation among government officials, representatives of affected interests, and academic researchers.

APPENDIX

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