



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

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## **Regulatory Policy Program**

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# Preface

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. With this in mind, the phrase "performance-based regulation" might seem a bit redundant, since all regulation should aim to improve society. Yet 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 kind of regulation that we have in mind and is the subject of this workshop report.

Incorporating performance goals into regulatory standards is by no means a new idea, but in recent years there has been renewed interest in expanding the use of performance standards in a variety of areas of health, safety, and environmental regulation. In keeping with its mission of advancing research and promoting policy outreach, the Regulatory Policy Program convened a workshop on May 13, 2002, to see what could be learned from agencies' experiences with performance standards and to begin to identify the likely conditions for the effective use of performance standards. The workshop brought together decisionmakers 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 sought to build on the experiences of different regulatory agencies that have used performance-based regulation and to clarify its advantages and disadvantages in addressing health, safety, and environmental problems. In some ways, this was a risky strategy as it is not always easy to build a dialogue among scholars and prac-

tioners who work in a variety of policy areas and academic disciplines. Yet the workshop was premised on the belief that we can learn most about the prospects for, and limitations of, performance-based standards by an interdisciplinary examination of their application across several regulatory policy areas. The dialogue that emerged from the workshop, and that is summarized in this report, revealed to us that this strategy was indeed an appropriate and useful one to take on this important topic.

Cary Coglianese  
Chair, Regulatory Policy Program

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This report represents the authors' efforts to summarize and synthesize the perspectives that emerged at the workshop. The views expressed do not necessarily reflect those of the Regulatory Policy Program, the Kennedy School of Government, Harvard University, or any of the sponsoring organizations. Furthermore, while this report summarizes the workshop discussion, it does not necessarily represent the views of all the participants nor should it be construed to represent any consensus statement or shared set of policy recommendations.



# 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, regulation can also set goals for the outcome of that behavior. When a regulation sets performance goals, and allows individuals and firms to choose how to meet them, it is called a performance-based regulation.

The idea of setting performance goals, rather than specifying behavior, dates back at least to the earliest-known publicly proclaimed law, the Hammurabi Code. Over the past decade, the idea of having government regulatory agencies set goals for performance has gained increasing attention. 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. 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. 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. 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 the most cost-effective way they can find.

Despite growing interest in the performance of government regulation, 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 ar-

ease 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.

There may well 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, and reliable and appropriate information about performance may sometimes be difficult if not impossible to obtain. 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 to use? 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 in May 2002. This report, 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

# 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 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.

The first of these conceptions – namely performance standards – is probably the most common in the literature on policy instrument choice, but the other notions of performance-based regulation also frequently arise in policy and academic discourse. In order to analyze effectively 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 report focused on the first of the above concepts, namely on 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 concrete measures to achieve that outcome up to the discretion of the regulated entity. In contrast to a design standard or a technology-based standard that specifies exactly how to achieve compliance, a per-

formance standard sets a general 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. The distinctions participants made were based on (1) the specificity 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 specificity of the regulations, performance standards can be either loosely or tightly specified. For example, a loosely 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 will call for regulators to make qualitative judgments, while many tightly specified standards will employ quantitative measures of performance.

Performance standards can also be distinguished according to how their 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 ob-

jective, such as water quality, rather than more narrow objectives, such as effluent limits. Related to this point, it was 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 much 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 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 decisionmaking. An important step for future research will be to develop a clearer conceptualization of the different types of performance standards.

# 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 in all situations, especially given the numerous conceptual differences among performance standards outlined in the previous section. In determining whether to use a performance standard, and if so, the specific type of standard to adopt (e.g., loosely vs. tightly specified), decisionmakers 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 for them to achieve the stated level of performance. Performance standards can also accommodate technological change and the emergence of new hazards in ways that prescriptive technology-based standards generally cannot. 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, something that is especially the case 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 pump in an industrial process. In such cases, they may actually offer little discretion to regulated entities. Even when performance stan-

dards are broadly defined, say by requiring a certain 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, it was 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 usually take the form of prescriptive standards that performance standards are supposed to replace.

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.

Related to this point, the risk of failure of a regulatory system was mentioned as an important consideration when deciding which type of regulatory instrument to use. Since the consequences of regulatory failure in the areas of airline safety or the operation of nuclear reactors will typically be more pronounced than in the areas of landfill operations or consumer products, the

nature 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. 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, it was generally acknowledged that there is a dearth of empirical studies aimed at measuring the effectiveness of performance-based standards, especially in comparison to the effectiveness of other regulatory instruments.

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 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, equivalency clauses, alternative compliance mechanisms, and codes of practice. In other words, any given regulatory response to a policy problem may mandate performance thresholds *and* particular technologies, or may set perform-

ance goals *and* provide prescriptive guidance in the form of codes of practice. For example, to ensure passenger safety in trains, the Federal Railroad Administration has required that train cars meet a performance-based crashworthiness standard but also has established a design-based protocol for train inspections.

It was generally agreed that all types of regulatory instruments have a role to play, depending on the situation at hand. The challenge for decisionmakers 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.

# Information and Uncertainty

Performance-based regulation raises a number of issues relating to uncertainty, information, and the role of experts in regulatory decisionmaking. Perhaps the biggest uncertainty of all 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.

It was 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 any such new discretion, though some participants argued that regulators with more professional training (or higher levels of education) might adapt more quickly. It was also noted that regulated entities can be uncomfortable with loosely specified performance standards because they believe they give regulators too much discretion when deciding enforcement issues.

Participants acknowledged that even tightly specified performance standards, and even 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 rela-

tionships 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 that contribute to a rare event occurring 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. 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 do not even know what they do not know. These and other limitations increase uncertainty when actual performance cannot be easily evaluated or verified. Moreover, such verification problems are not limited to rare, high-consequence events, such as fires or nuclear meltdowns, but can arise in any situation where performance cannot be measured reliably.

One participant voiced concern that performance standards based on 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 find problems with the analysis.

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. Some participants cautioned that these new tools require

large amounts of data to run successfully; however, others noted that such tools are the most valuable when few data are 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, it was suggested, is to use all of the available evidence at hand: statistical, laboratory, and expert judgment. A systematic approach to this evidence can help focus decision-making on the important issues. However, it was also noted that quantification of uncertainty sometimes makes decisionmaking more difficult because even after using predictive models, policymakers must still decide how much 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. 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 from 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,” according to 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. 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 adaptive learning or a learn-as-you-go approach. Given some of the perceived limitations of predictive models, a further question was raised about whether we should invest limited resources in developing better models or in gathering empirical data about the effects of performance-based standards.

One participant argued that even though an advantage of performance-based regulation is that it can decentralize government by giving firms greater flexibility, government must still monitor each firm’s performance, and this may require the government 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 government needs to know.

Some participants noted an inconsistency between the Government Performance and Results Act, which requires agencies to evaluate their own performance, and the Paperwork Reduction Act, 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 knowledgeably participate in regulatory decisionmaking declines as the complexity of the analysis increases, thereby causing 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 that underlies 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. Effective communication about risk, uncertainty, and performance puts information into the hands of those ultimately affected by regulatory policy and therefore promotes democratic values.

# 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 best practices for implementing performance-based regulation. One participant claimed that although there is a great deal of potential evidence in the form of existing regulatory programs, it will require substantial effort to gather and analyze it. 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. They 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. 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 perform-

ance-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 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 use of performance-based approaches in systems that were not designed for that purpose. How does 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. It was suggested that regulatory regimes do not change on their own; what changes is the ability of regulatory decisionmakers to acknowledge and absorb uncertainty. The important thing is 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). It was 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”).

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. Letting industry choose its own path, therefore, always presents the possibility of generating new or even larger risks. In contrast, design-based standards provide clear direction to regulated entities and agency enforcement staff, an approach which may be satisfactory even if not optimal.

Several participants argued that making the transition to a performance-based system also requires changing the prevailing approach to enforcement. Instead of just 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 per year that a nuclear power plant shuts down 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 takes progressively 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 de-

cisions and process improvements on performance is not always immediate, sometimes taking years to manifest itself, 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. 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, it was suggested that 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, government could charge a fee for behaviors that increase risk. Alternatively, performance-based approaches could be integrated into market-based or incentive-based regulation. For example, one participant noted that the Clean Air Act's Risk Management Program uses an approach that allows trade associations, insurers, and community residents to provide firms with additional incentives to perform well.

Participants noted that all of the issues related to uncertainty described earlier in this report 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. It was also suggested that the Office of Management and Budget's review process should take into account the different kind 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, it was agreed that dialogue between government and industry is important in developing performance-based standards. By engaging with business, for example, 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. Dialogue also can be used to educate and inform stakeholders about performance-based regulation, thereby making them more comfortable with the transition. It was also mentioned that dialogue may help expand the set of possibilities available to regulators, and it can create an industry-wide yardstick for assessing performance.

Even if dialogue does not result in a new rule or a change to an existing rule, one participant argued that the process can help the regulated community focus on why a problem is of concern and may lead to change over the long term. 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, it was pointed out that performance data and careful program evaluation will be necessary to inform both dialogue and agency decisionmaking.

# Conclusion

Expanding the use of performance-based regulation holds promise for achieving health, safety, and environmental goals at 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. No matter what options are considered, each will have uncertainty associated with it. It may even be that performance-based options will draw greater attention to this uncertainty in some situations. As with any decisionmaking, of course, addressing uncertainty will call for a careful analysis of all the available evidence as well as effective communication of this evidence to decisionmakers and the various affected parties.

Participants suggested that expanding the use of performance-based regulation to new areas, even when appropriate, may well 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 as well as a dearth of careful evaluation of performance-based approaches may well 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 A

## Workshop Agenda

### Welcome and Introductions

- Moderator, Cary Coglianesi, Chair, Regulatory Policy Program, Harvard University

### “The Place of Performance-Based Regulation in the Regulatory Tool Box”

- Presenter: Neil Gunningham, Professor, Australian National University
- Commentator: Paul Portney, President, Resources for the Future

### “Agency Experiences with Performance-Based Safety Regulation”

- Presenter: N. Prasad Kadambi, Senior Reactor Engineer, Office of Nuclear Regulatory Research, U. S. Nuclear Regulatory Commission
- Presenter: Jeffrey D. Wiese, Director of Program Development, Office of Pipeline Safety, U.S. Department of Transportation Research and Special Programs Administration

### Luncheon, “The Search for Analytic Measures of Performance for Health and Safety Agencies”

- Keynote Speaker: John Graham, Director, Office of Information and Regulatory Affairs, Office of Management and Budget

### “Implementing Performance-Based Regulation Under Uncertainty”

- Presenter: Paul Fischbeck, Associate Professor of Social & Decision Sciences and Engineering and Public Policy, Carnegie Mellon University
- Commentator: George Apostolakis, Professor of Nuclear Engineering and Engineering Systems, Massachusetts Institute of Technology
- Commentator: John Hall, Assistant Vice President for Fire Analysis and Research, National Fire Protection Association

### Closing Discussion

# Appendix B

## Workshop Participants

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