Recent revisions to the air quality standards show a worrisome misuse of science.

The EPA's Risky Reasoning

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FOR REGULATORY DECISIONMAKERS, science provides a systematic basis for understanding policy problems and the consequences of different policy options. Thus, scientific evidence needs to play a key role in agency decision-making. But even though science is valuable for what it can tell administrators about policy problems and their possible solutions, science does not by itself provide a complete reason for a policy decision because it does not address the normative aspects of administrative policymaking.

The Environmental Protection Agency's efforts to justify recent changes to its National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter (PM) exemplify the use — and misuse — of science by government agencies. Given the way the EPA and the courts have interpreted the Clean Air Act, the agency has been able to cloak its policy judgments under the guise of scientific objectivity. By doing this, the EPA has evaded accountability for a shifting set of policy positions that have major implications for public health and the economy. The EPA's incoherent approach to its NAAQS decisions ultimately fails to live up to the aspiration for reasoned decision-making that undergirds contemporary administrative law in the United States.

SCIENCE AND RISK STANDARDS

Throughout its recent ozone and PM rulemakings, which were finalized in July 1997, the EPA attempted to justify its selection of its air quality standards based solely on scientific evidence regarding the health effects of pollution. By purporting to rely on science to justify normative policy decisions, agencies like the EPA succumb to a category mistake because science speaks to what *is* rather than to what *should be*. Relying exclusively on science, as the EPA has done in its ozone and particulate rulemakings, is as misguided as it would be to disregard relevant scientific information altogether.

NON-THRESHOLD POLLUTANTS The Clean Air Act provides that in promulgating a new or revised NAAQS, the EPA must draw upon a "Criteria Document" that reflects "the latest scientific knowledge" of the health effects of the relevant pollutant. Then, under Section 109 of the act, the EPA is to set a standard that is "requisite to protect the public health" with "an adequate margin of safety."

The legislative history of the Clean Air Act provides some additional guidance for construing the brief statutory language. In 1970, when the current language of Section 109 was enacted, the Senate report on the legislation stated that the objective of air quality standards is to ensure "an absence of adverse effects on the health of a statistically related sample of persons in sensitive groups." NAAQS were intended to protect susceptible groups such as "bronchial asthmatics and emphysematics who in the normal course of daily activity are exposed to the ambient environment." Based on this language, the EPA and the courts have construed Section 109 to require air quality standards to "be set at a level at which there is 'an absence of adverse effect' on . . . sensitive individuals."

Moreover, NAAQS must provide a "margin of safety" to ensure that "a reasonable degree of protection is to be provided against hazards which research has not yet identified." Thus, at least as reflected in the 1970 Senate report, the EPA is required

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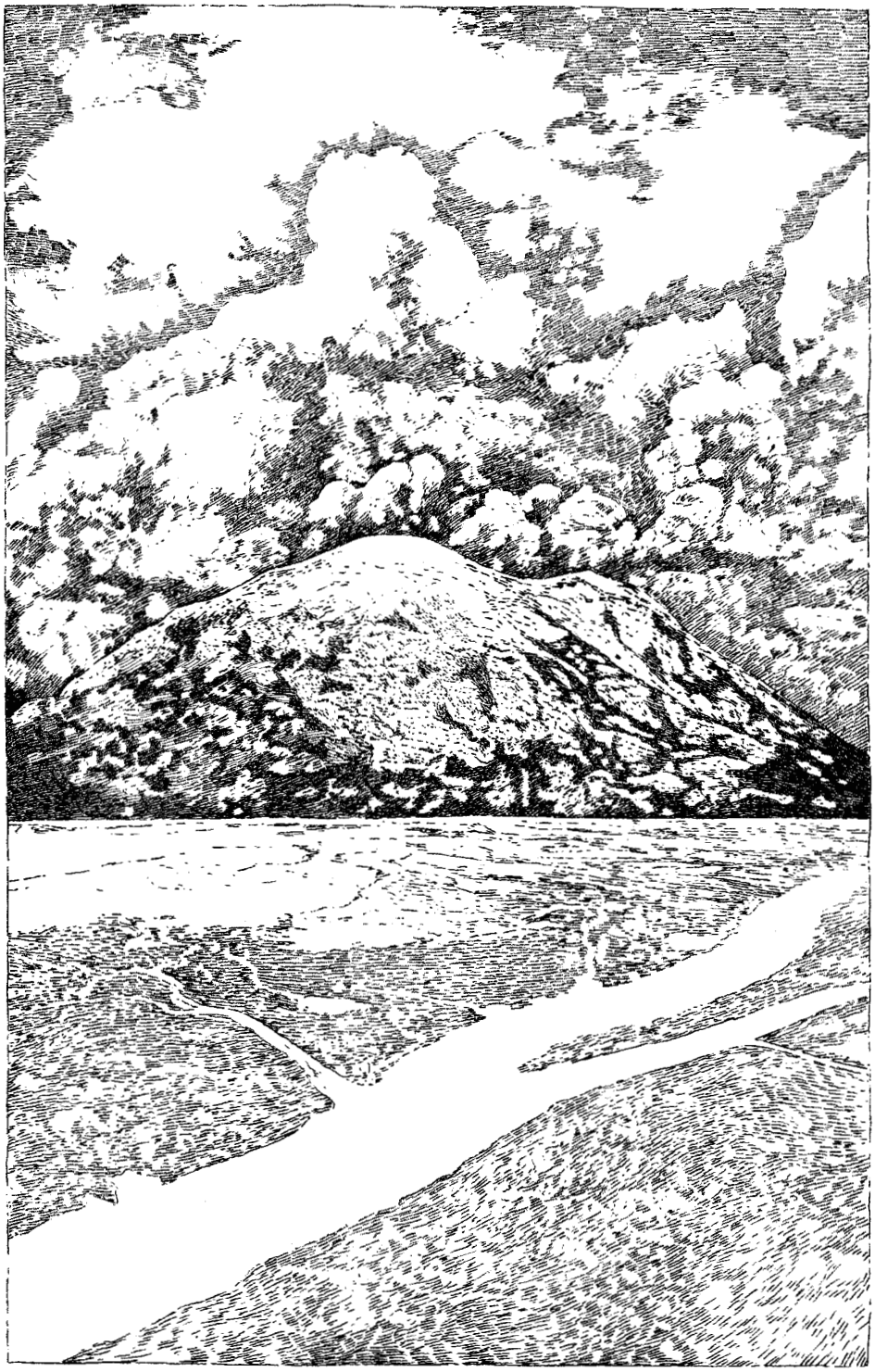

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to set NAAQS at a level that would ensure no detectable adverse health effects in even susceptible sub-groups of the population, and then to add an additional margin of safety to protect against unknown health risks that may be discovered in the future. In short, the NAAQS are apparently intended to provide near-absolute protection against adverse health effects.

The statutory provisions for adopting NAAQS, initially enacted in their present form in 1970, are based on the assumption that pollutants have thresholds for which it is possible to set a "safe" level. Such a "threshold pollutant" causes adverse effects only above a certain exposure level, which is designated as the threshold level. In contrast, a "non-threshold" pollutant is one that may cause adverse effects at any level above zero exposure.

For threshold pollutants, it would appear as if science alone might almost be sufficient to determine the level at which an air quality standard should be set. If a pollutant shows a clear threshold, then science would presumably provide the basis for using that threshold as a "safe" point below which the regulator could be assured the complete protection of public health.

But even with threshold pollutants, some judgments would still be required on the part of the EPA administrator. In particular, the administrator must make a clear policy judgment in selecting an "adequate margin of safety" to protect against uncertain or unknown health effects at lower exposure levels.

The need for making a policy judgment is even clearer for non-threshold pollutants. Unlike threshold pollutants, for which a standard can be set at a level below the threshold to provide complete health protection, the only way to protect against all adverse health effects from a non-threshold pollutant would be to set a standard at the level of zero. Given the continuum of health effects for the non-threshold air pollutants, no standard other than zero can provide complete and certain protection against all adverse health effects. As a result, when regulators set standards for non-threshold pollutants at levels other than zero, they must at least implicitly do so based on some criteria other than the science. That is because the science indicates that health effects likely occur at levels below any standard selected by the regulators.

It turns out that few, if any, criteria pollutants regulated under the Clean Air Act exhibit a clear threshold. The scientific data for ozone and fine PM indicate a continuum of health effects down to background (or natural) concentrations of the pollutants in the air, at which point the health effects associated with the pollutants cannot be distinguished from effects caused by other factors. In other words, there is no identifiable threshold below which a standard for ozone or particulates could be set to avoid all health effects.

Congress has never amended the statutory language of Section 109 to reflect that recognition. Nor has it provided any fur-

ther guidance to the EPA on how to justify a non-zero standard for a non-threshold pollutant in a way that would satisfy the Clean Air Act's requirement to "protect the public health . . . with an adequate margin of safety."

THE ABANDONMENT OF REASON

The selection of a NAAQS standard, especially for a non-threshold pollutant, is a quintessential risk management decision that, while drawing on scientific evidence, ultimately turns on social, political, and economic choices. The EPA's most recent revisions to its ozone and fine PM NAAQS not only illustrate the so-called "science charade," but more importantly they reveal what follows from a regulatory regime that permits, and even encourages, agencies to cloak their policy decisions as science. When the EPA or any other agency invokes science to justify its regulatory decisions, it fails to provide the public with a transparent and principled justification for its regulatory decisions.

LISTEN TO THE SCIENCE In July 1997, the EPA promulgated its revised primary NAAQS for ozone and particular matter. The agency revised the previous one-hour, 0.12 parts-per-million primary ozone standard to an eight-hour, 0.08 ppm average standard. It also added two new fine PM standards — a 15 micrograms per cubic meter ($\mu g/m^3$) annual standard and a 65 $\mu g/m^3$ daily standard for $PM_{2.5}$ — while retaining the existing PM_{10} standard with only minor technical changes.

Industry groups and three states filed petitions seeking judicial review of the standards in the United States Court of Appeals for the District of Columbia Circuit. In the initial round of that litigation, the EPA argued that its "scientific review" led it "to the inescapable conclusion" that the existing NAAQS were not protecting the public health with an adequate margin of safety. After a panel of the Court of Appeals rejected the EPA's decisions on nondelegation grounds, finding that the agency failed to articulate an intelligible principle to guide its NAAQS selection, the EPA appealed to the United States Supreme Court.

The agency argued before the Supreme Court that its decision under the Clean Air Act did not offend the nondelegation doctrine because the EPA had been constrained by three types of factors that together effectively constituted an "intelligible principle." The three factors were the agency's Criteria Documents reflecting "the latest scientific knowledge," the advice from the Clean Air Science Advisory Committee (CASAC), and the rulemaking procedures specified in Section 307(d) of the Clean Air Act. The first two factors — the Criteria Documents and CASAC advice — emphasized scientific inputs exclusively. Because the last factor was merely a procedural limitation, the EPA in effect argued that science alone provided the agency with an intelligible principle for selecting a NAAQS standard.

The agency's resort to this "science only" justification before the Supreme Court comported with comments made by the EPA administrator in testimony before Congress and in numerous public speeches. In those presentations, Administrator Carol Browner repeatedly implored her audience to "listen to the science" that she suggested led inexorably to the particular standards selected by her agency.

AD HOC RULEMAKING In asserting reliance on science, the EPA claimed that it did not need to provide any consistent set of policy principles to explain its decisions. Throughout its rulemakings, what the agency left unaddressed was the critical question of what risk-management principle or criterion justified the administrator's "policy choice" in selecting non-zero standards along the continuum of predicted health risks for ozone and fine PM.

It is not surprising, then, that the EPA has been inconsistent in how it set the margin of safety required by the Clean Air Act. In particular, the agency has shifted its position on whether the margin of safety provision requires it to set primary standards below the lowest probable adverse effects identified by scientific studies. In the recently revised ozone standard, the EPA set the primary standard at 0.08 ppm, a level at which it claimed that adverse health effects were directly observed in clinical studies.

In past rulemakings, however, the EPA has taken the position that the margin of safety requirement directs the agency to set the standards below the level at which adverse health effects are found or expected in sensitive groups. For example, in its previous revision of the ozone standard in 1979, the EPA concluded that "the most probable level for adverse health effects in sensitive persons ... falls in the range of 0.15–0.25 ppm." Nevertheless, the agency set the standard at 0.12 ppm, well below the probable effects level, based on its statutory interpretation that it is required to make a "judgment of a standard level below the probable effect level that provides an adequate margin of safety."

When it came to its recent ozone and PM revisions, the EPA abandoned its earlier approach. It even argued in court that it was not "required to follow any particular paradigm of decision-making" and that "nothing in the statute requires [the administrator] to make any specific 'findings' or to structure her decision-making in any particular way." The EPA's inconsistent application of the margin of safety concept, combined with its assertions that it did not even need to try to be consistent, revealed an agency dodging its responsibility for giving the public a principled justification for its preferred policy outcome.

PM The EPA's interpretation of the scientific evidence of the health effects from PM demonstrated that statistically significant levels of premature mortality and significant morbidity would remain even under the agency's new 24-hour standard of 65 $\mu g/m^3$ for fine PM. What stopped the agency from further tightening its daily fine-PM standard to an even more stringent level and thereby saving thousands of additional lives? Certainly not any justification based exclusively on a concern for protecting the public from health risks.

The EPA argued that a more stringent 24-hour standard was either unnecessary or based on data that were too uncertain. However, those arguments were belied by other actions the agency took. The data showing a continuing risk below the EPA's selected standard came from the very same studies that the agency used to justify reducing the standard to its selected level. If the same data were too uncertain to justify tightening the standard still lower, then they should have also been too uncertain for the EPA to have relied on when adopting its new standard in the first place.

As to the lack of necessity for reducing the 24-hour standard still lower, the EPA's analysis of the data indicated that a more stringent standard would have saved an additional 860 lives per year in just the two cities the agency studied (Los Angeles and Philadelphia). The acceptance of this significant residual risk was inconsistent with the EPA's policy in past NAAQS rulemakings as well as its decision to revise the ozone standard even in the absence of a showing that lives were at risk.

OZONE The EPA selected its new 0.08 ppm, eight-hour ozone standard based primarily on evidence showing that the new standard would reduce the median percentage of children experiencing lung function decrements by less than one percent (0.9 percent) relative to a 0.09 ppm standard (which was roughly equivalent to the pre-existing 0.12 ppm, one-hour standard). Yet, the agency's own analyses indicated that a 0.07 ppm standard would further reduce this same health endpoint by a similar if not greater amount. If reducing this endpoint by 0.9 percent was "requisite to protect public health," then consistency should have dictated that reducing the same endpoint still further by a similar amount would have been "requisite."

As the agency proceeded through several rounds of litigation over the ozone revisions, it came upon a purported explanation for its choice of the 0.08 ppm standard offered by a dissenting judge. In the initial round of review, a panel of the D.C. Circuit Court held that the EPA failed to articulate an "intelligible principle" to constrain its discretion. Dissenting from the panel's holding, Judge David Tatel signaled what would become a more refined, science-based argument that the agency would advance in subsequent rounds of litigation.

Judge Tatel argued that the scientific evidence and advice on ozone did indeed provide a clear basis for the EPA's choice of a new NAAQS standard. Tatel noted that "different types of health effects [are] observed above and below 0.08 ppm," the level selected by the EPA. Specifically, he opined that the health effects below 0.08 ppm were qualitatively different in that they were "transient and reversible." In petitioning the D.C. Circuit for a rehearing and advancing arguments on further appeal, the EPA resurrected Judge Tatel's arguments in defending its air quality standards. The agency argued that it "sets primary NAAQS at levels that provide protection from medically significant risks and not at levels that protect against any and all risks, or any and all effects." The agency also asserted that the standards should be set at the lowest level at which studies indicated a statistically significant increase in "adverse effects," which the agency redefined as health effects that are not "transient and reversible." The EPA thus argued to the court that the scientific evidence on ozone indicated a break point at 0.08 ppm, even though the agency also acknowledged, and the record showed, that there was no known threshold for health effects from ozone.

Moreover, while the record showed a continuum in the frequency and severity of respiratory effects at successively lower ozone levels, it did not show a discernible discontinuum at 0.08 ppm between those effects that were "transient and reversible" and those that were more permanent, as Judge Tatel and the EPA argued. Most of the respiratory effects on which the agency relied to lower the primary ozone standard down to 0.08 ppm were also transient and reversible. Thus, while it is true that the health effects from ozone become, in a certain sense, more transient and reversible at lower levels, the "bright line" that Judge Tatel and the agency claimed to discern at 0.08 ppm was not supported by the available empirical evidence.

Most significantly, in invoking a distinction between effects that are "transient and reversible" and those that are not, the EPA again shifted its position from past rulemakings without offering any reasons for doing so. When the agency last revised the ozone standard in 1979, it relied on the very same types of transient respiratory health effects to support its standard, expressly finding that such effects were of concern and "adverse" — "even when reversible" and "even though transitory." Similarly, when the agency previously revised the PM standard in 1987, it set the standard "in the lower portion of the range where sensitive, reversible physiological responses of uncertain health significance are possibly, but not definitely, observed in children." The EPA's attempt to construct a scientific demarcation based on whether or not effects are "transient and reversible" was therefore neither supported by the record nor consistent with the agency's own past decisions.

HEALTH BENEFITS One of the most striking examples of regulatory incoherence in the EPA's NAAQS revisions lies in the disparity between the health benefits from the revised ozone standard and the revised PM standard. In rejecting a more stringent alternative for the PM standard, the EPA rejected an option that would have achieved a much greater gain in health benefits than the gain the agency anticipated it would achieve by revising its ozone standard. If protecting the public health with an adequate margin of safety did not require the EPA to lower the PM standard still further, then it is far from clear why the agency was justified in revising its ozone standard as it did.

Based on staff analysis and consistent with CASAC's advice, the agency assumed in revising its ozone standard that its new NAAQS would not achieve any reduction in mortality. In quantifying the non-mortality health benefits of the new ozone standard, the EPA estimated the total monetized value to be $60 million. In contrast, the EPA estimated the incremental health benefits of lowering the daily $PM_{2.5}$ standard from the selected 65 $\mu g/m^3$ level to 50 $\mu g/m^3$ would be $1.6 billion because of the reduction in non-mortality risks alone. (The agency's analysis did not permit an estimate of health benefits from the reduction of mortality risks, which would have made the discrepancy between the PM and ozone cost-effectiveness even more dramatic.)

The EPA's analysis clearly indicated that the health benefits foregone by the decision not to tighten the $PM_{2.5}$ daily standard below the 65 $\mu g/m^3$ level dwarfed the total health benefits of the ozone standard. The agency claimed that its ozone revision was necessary in order to protect public health with an adequate margin of safety. But it also argued that a further tightening of the PM standard to achieve significantly greater health benefits was not necessary to protect public health with an adequate margin of safety. The EPA offered no explanation for why its treatment of health risks should vary markedly from one pollutant to another.

TOWARD MORE PRINCIPLED RISK MANAGEMENT

If the EPA is to provide a more coherent justification for significant decisions than it did for its most recent NAAQS revisions, how can it do so?

PRINCIPLES A regulatory agency such as the EPA has four basic approaches available that it can use to provide a consistent justification for making risk management decisions such as setting ambient standards:

- Eliminate all risks (or all non–naturally occurring risks).
- Avoid unacceptable risks.
- Avoid unacceptable costs (sometimes described as the feasibility approach).
- Balance costs and benefits.

Although these approaches are not all equally sound strategies nor are they all currently permissible under the Supreme Court's interpretation of the Clean Air Act, they do illustrate the range of possible ways to provide a consistent explanation for risk management decision-making.

ELIMINATE ALL RISKS The first approach is conceptually straightforward: Eliminate all risk. This principle could be consistently applied if the EPA set its standards at levels at which it believed there would be no risk to health. The agency could also take a consistent risk-management approach if it chose to minimize risk by setting standards at background levels, thereby opting to eliminate all risks except those that are naturally created (a zero–additive risk approach).

Of course, for non-threshold pollutants that lack countervailing health benefits, the minimize-risk principle can be applied consistently only if the EPA sets its standards at a zero or background concentration level, something that would effectively call for the elimination of all economic activities. Quite sensibly, the agency has expressly disavowed any intention of adopting a zero-risk approach, and the Supreme Court has also recognized the folly of such an approach. If the EPA is to adopt a more coherent approach to its risk management decision-making, it will almost certainly need to choose some other principle to justify its decision-making.

AVOID UNACCEPTABLE RISKS A second approach would be for the agency to establish a level of acceptable risk and to rely on such a level across its air quality standards. Rather than always trying to minimize all risks, the agency would only reduce risks to an acceptable level.

The acceptable risk approach has been used in other regulatory contexts. For example, in setting standards for hazardous air pollutants, the EPA has presumptively defined "acceptable risk" based on a maximum individual mortality risk of no greater than one in 10,000. The agency has similarly set acceptable risk targets in other contexts, including the regulation of water quality, hazardous wastes, and pesticides. The Occupational Safety and Health Administration follows a similar approach, using a benchmark mortality risk of one in 1,000 as the level of "significant risk" on which it bases occupational health standards.

Extending an acceptable risk approach to NAAQS decision-making would not be easy, however, because criteria pollutants such as ozone and PM create varied types of health effects other than mortality. Most "acceptable risk" benchmarks established by the EPA under other regulatory programs focus on cancer mortality. But many of the health effects considered by the agency for pollutants such as ozone involve continuous health effects (e.g., respiratory irritation) that vary in intensity from serious illness to a minor nuisance. It is generally harder to define an acceptable risk level for such continuous effects because it is necessary to address both the frequency and severity of the disease. Moreover, a common metric for morbidity is needed to compare alternative standards, each of which may vary along multiple dimensions of predicted health effects (such as if exposure contributed to circulatory as well as to pulmonary problems).

Another issue with the acceptable risk approach is whether to rely upon individual or population risk — or both. The EPA has yet to adopt a clear and consistent position on whether it should base its NAAQS decisions on maximum individual risk or population risk. In its recent ozone revision, the EPA appeared in some ways to accept a population-risk approach. Yet in a previous NAAQS rulemaking, the agency explicitly indicated that the number of people exposed was not relevant because "standards must be based on a judgment of a safe air quality level and not on an estimate of how many persons will intersect with given concentration levels." The problem with relying only on levels of risk to individuals, of course, is that it overlooks the number of people exposed to the risk, something that clearly affects the level of overall benefits from a regulatory standard.

Although a benefits-based approach may help to identify inconsistencies across rules, by itself such an approach still skirts the underlying question of what makes a particular level of risk "acceptable" or a particular level of benefits "desirable." The acceptable risk approach suffers from another notable limitation: It ignores the costs of meeting those standards.

AVOID UNACCEPTABLE COSTS A third approach to consistent risk management would keep costs below unacceptable levels. For example, OSHA is charged by statute with developing regulations to protect workers from exposure to toxic substances "to the extent feasible." To say that a standard is feasible is to say that its costs are acceptable. Of course, just stating that a regulatory standard is "feasible" or "infeasible" is rather imprecise. However, just as agencies have operationalized the concept of acceptable risk by setting specific risk targets, they could similarly develop precise standards establishing acceptable and unacceptable levels of costs.

Such an approach, though, would disregard the benefits of risk standards. If a standard with exceedingly high costs (or that would cause severe economic disruption) would also save many thousands of lives, then society almost certainly would be better off with the standard even if the costs are high. For example, government regulations eliminating lead from gasoline resulted in hundreds of millions of dollars in annual costs and appeared to threaten not only dislocations for the industrial firms that produced lead additives but also potential gaso-

line shortages during the transition to unleaded fuels. But those regulations also resulted in dramatic health benefits for society, benefits that dwarfed the costs substantially. If regulatory agencies had consistently adhered to an approach that avoided all regulations that imposed costs exceeding a specified level or threatened economic dislocation without any concern for the level of corresponding benefits, they may well have delayed or avoided phasing out lead additives in gasoline.

BALANCE COSTS AND BENEFITS To avoid such a perverse outcome, a fourth approach for risk management would take both benefits and costs into consideration and seek to achieve a consistent balance of the two. By taking both costs and benefits into consideration, regulators would be able to set risk management standards so as to achieve positive net benefits, setting them at the level at which the benefits most outweigh the costs. Several environmental statutes other than the Clean Air Act direct agencies to balance benefits and costs when they are setting risk standards. Indeed, absent statutory prohibitions to the contrary (such as in the Clean Air Act), regulatory agencies are directed by Executive Order 12,866 to assess both costs and benefits of significant proposed regulations and are supposed to "propose or adopt a new regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs."

AD HOC APPROACH Strikingly, the EPA has not only rejected a benefit-cost approach in setting air quality standards, it has rejected all four general policy principles. It has explicitly ruled out zero-risk and acceptable risk approaches, and it has successfully argued in the courts that the Clean Air Act precludes it from adopting a feasibility or benefit/cost balancing approach.

Instead, the EPA has taken an explicitly ad hoc approach. Given this predicament, it should not be surprising that the agency's account of its recent NAAQS decisions has been so inconsistent. An important step toward achieving a more principled and consistent account of the EPA's air quality standards would be to free the agency from the conceptual straightjacket in which it now finds itself and acknowledge the fiction that its risk management decisions can be made in the absence of any consideration of costs.

ABANDONING A FICTION The estimated costs of the recently revised ozone and PM standards make them among the most expensive federal regulations ever promulgated in the history of the United States. The EPA estimated that the standards would impose incremental costs exceeding $45 billion per year, an amount larger than the annual cost of all other Clean Air Act programs in effect at the time. The agency claims not to have considered costs in setting its recent air quality standards, and the high costs associated with them would appear to support that claim. Yet it is widely recognized that the EPA does, and indeed must, at least implicitly consider costs in deciding where to set air quality standards, the high costs of the recent ozone and particulate standards notwithstanding.

Society would be better off if the agency considered cost estimates explicitly rather than treating the issue of cost only implicitly. That is because costs may exhibit discontinuities and non-linearities that can only be discerned through careful analysis of cost functions. For example, the EPA's draft Regulatory Impact Analysis for ozone, published at the time of the agency's proposed rule, indicated that an eight-hour ozone standard set at 0.08 ppm based on the fifth rather than the fourth highest annual concentration would provide roughly equivalent health protection but at approximately 20 percent lower cost. Had the EPA explicitly taken this information into account, it could have based the standard on the fifth highest annual concentration and saved the nation over $1 billion per year without sacrificing health protection.

Society would be better off if the EPA were to consider regulatory cost estimates explicitly rather than treating the issue of cost only implicitly.

Such an open consideration of costs would not only likely ensure more cost-effective policy decisions, it would also better serve some of the core principles that undergird administrative law. As John Graham, a risk expert who now heads the Office of Information and Regulatory Affairs, has noted, the EPA's "legal fiction" of not considering costs when setting NAAQS "reduces political accountability for value judgments and political choices, [and] hides from public scrutiny claims that are made about risks, benefits, and costs (since such claims are driven 'underground' in the course of regulatory deliberations)." Put more simply, as Professor David Faigman has recently argued, the "real loser in the PM/ozone drama was candor." By framing the standard-setting decision as one for which costs cannot be taken into consideration, the EPA, Congress, and the courts have endorsed a misleading and ultimately fictional basis for setting air quality standards.

REFORM What steps can be taken that might lead the EPA to adopt a more candid and coherent account of its risk management decision-making? If the aspiration of well-reasoned agency decision-making is to become a reality for risk management of non-threshold air pollutants, Congress will need to step in both to authorize and encourage the EPA to break free

from its current, incoherent approach. The Clean Air Act itself will need to be amended if the agency is ever to pursue a principled approach to air quality standard setting.

Judicial review would have once been considered an option for encouraging the EPA to adopt a more candid and consistent justification for its decision-making. But the Supreme Court recently upheld the agency's revised ozone and PM standards in a unanimous opinion authored by Justice Antonin Scalia. The Court interpreted the Clean Air Act in such a way as to preclude the administrator from considering costs. With the Supreme Court effectively affirming the incoherent approach embedded in the longstanding interpretation of the Clean Air Act, it was not surprising that the D.C. Circuit, on remand, upheld the EPA's revised standards under the arbitrary-and-capricious test and deferred ultimately to the agency's "expert judgment." In the end, the EPA prevailed and secured judicial approval for its explicitly ad hoc decision-making.

Legislative change will not come easily, but it may become more viable when the absurdity of the Clean Air Act's outmoded legislative model becomes evident to those across the political spectrum. That was the case with the Delaney Clause, which Congress amended after many years once the act was interpreted to require the elimination of all cancer risks from pesticide residues in food. If the Clean Air Act follows a course similar to that taken with the Delaney Clause, then ever-advancing knowledge about the adverse effects from still-lower levels of air pollutants may force the EPA and Congress to confront the absurdity of the current interpretation of the Clean Air Act. For example, the recent identification of genetic susceptibilities to pollutants such as PM and ozone may well only heighten the demand under the existing statutory framework to set even more stringent standards at levels that are not economically or politically feasible.

As scientific research continues to document the public health effects that the EPA already acknowledges remain under its revised standards, the pressures to lower air quality standards ever closer to zero will persist and seem likely only to increase over time. So will, of course, the costs for complying with more stringent standards. Perhaps fortunately, at least for those who value reason and candor in governmental policymaking, this dynamic will eventually result in a broader recognition of the need for statutory reform. If this is correct, then perhaps it will only be a matter of time before Congress steps in and adopts a more realistic legislative approach that will bring clarity to this important domain of risk management.

CONCLUSION

The recent revisions of the ozone and PM standards confirm what has been widely known since at least the mid-1970s, namely that Section 109 of the Clean Air Act is not realistic. As scientific knowledge has expanded, health risks have been identified at ever lower levels. In light of this evolving evidence, it is no longer possible to select a standard that protects the public health, with an adequate margin of safety, from all the adverse effects of non-threshold pollutants, at least not without imposing dire economic costs on the nation. As a practical matter, the EPA has had little choice but to disregard evidence about substantial adverse effects on a public whose health the agency is directed by law to protect.

But the agency has been neither candid nor consistent about the policy choices it has made in revising the nation's air quality standards. Instead, it has successfully shielded its policy decisions behind the language of science and expertise. When agencies rely on science to explain the policy decisions they make, they not only escape from fulfilling their duty to provide a principled account of their decision-making, but they also can find themselves vulnerable to expediency and post-hoc rationalization in their efforts to defend their actions.

We have argued that the courts' acceptance of a dysfunctional legislative framework means that, to achieve greater consistency in air quality standard setting, Congress will need to compel the EPA to come clean about what science can and cannot say and about what policy principles justify its standards. The agency cannot simply "listen to the science" to tell it how to make policy choices about how many adverse health effects or how much regulatory cost should be tolerated in society. Risk management calls for value judgments that are both possible and desirable for public officials to defend through policy analysis and normative reasoning. To be sure, high-quality scientific analysis is vitally needed to inform decisionmakers about policy problems and to predict the consequences of different solutions, but appeals to science are no substitute for clear and careful reasoning about the normative choices inherent in public policymaking. R