Needed: someone to police the environmental police

EPA Pats Itself on the Back

BY RANDALL LUTTER AND RICHARD B. BELZER

CAREFUL ECONOMIC ANALYSIS CAN IDENTIFY policy reforms that improve the efficiency of federally mandated environmental protection efforts. Like nothing else, good economic analysis helps focus our minds on the inevitable and frequently uncomfortable tradeoffs between clean air and those things we must sacrifice to obtain it. Analysis can change the political landscape from a quest for mythical perfection at any price to a debate about the price the public should pay for the next incremental improvement in air quality. Without good analysis, we will achieve the right level of air quality only by dumb luck.

But government studies of regulations designed to protect health, safety, and the environment are inherently self-serving. The same agencies that evaluate performance also design and administer the very regulatory programs that they are evaluating. It is hard to understand why anyone should expect self-examinations to be objective and informative. Investors want businesses to be audited by analysts without financial conflicts of interest. Scientists reject research that cannot be replicated independently. Consumers flock to independent testing organizations rather than rely exclusively on sellers' claims. Only in the public sector, where bureaucracies are protected from the discipline of market forces, do we rely on self-evaluations of performance.

Interest in more efficient environmental regulation motivated lawmakers in 1990 to include Section 812 in the Clean Air Act amendments. Section 812 directs the Environmental Protection Agency (EPA) to report to Congress on the costs and benefits of the federal air pollution control program. In 1997, EPA's first report on rules issued from 1970 to 1990 gave a "best estimate" of net benefits of $22 trillion—roughly the aggregate net worth of all U.S. households in 1990. We know of no professional economist independent of EPA who takes that estimate seriously. In the 1999 sequel to its 1997 report, EPA gave a "central" estimate of $83 billion for the net annual benefit in 2010 of the Clean Air Act amendments. That estimate did not include the net benefit of efforts to protect stratospheric ozone, which EPA estimated separately.

As we will show, EPA greatly overestimated the net benefits of the Clean Air Act amendments. The agency deliberately neglected the cost of complying with a well-known, and expensive requirement of the act and ignored its own scientific advisory board's advice to include indirect costs. EPA described its key benefits estimate as a "central" case, although it is better interpreted as an upper-bound estimate. It is likely that there will be negligible net benefits in 2010. Moreover, EPA's focus on aggregate net benefits obscures the gains that might result from better design and administration of the clean air program.

EPA's reports to Congress vividly illustrate the inadequacy of self-evaluations of federal regulatory programs. Congress should abandon the self-evaluation model and establish an independent analytical agency to review the costs and benefits of regulatory policies and programs.

OMITTED ALTERNATIVES

BOTH EPA'S REPORTS TO CONGRESS HAVE NO VALUE FOR legislative or regulatory decision making because, among other things, they do not analyze a range of reasonable policy alternatives. In fact, the second report fails to analyze a single alternative. It tells us nothing about the merits of incremental policy changes, let alone significant changes in program design or administration. It is silent as to whether tightening or relaxing air pollution controls would increase or decrease net social benefits. Yet, such information is essential to making informed judgments about changes in laws or regulations.

Sound economic analysis requires the assessment of

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alternatives. Kenneth Arrow and other leading economists, writing in *Benefit-Cost Analysis in Environmental Health and Safety Regulation: A Statement of Principles*, noted that it is "important to identify the incremental costs and benefits associated with *different* regulatory policies" (Principle 8 on p.7, emphasis added). Inspired in part by economists' views about sound analysis, presidential executive orders (e.g., EO 12866) and guidelines of the Office of Management and Budget also require the assessment of alternatives.

EPA's neglect of alternatives testifies to the triumph of its institutional interests over responsible policy analysis. The agency's reports to Congress demonstrate how it seeks to control and constrain the role of benefit-cost analysis in public debates about air pollution control policy.

UNINFORMATIVE AGGREGATES

WHAT TRUTHS HIDE BEHIND EPA'S AGGREGATE ESTIMATES of costs and benefits? The Clean Air Act has many provisions. Which provisions generate the greatest net benefits? Are there provisions whose costs exceed their benefits? Without the answers, decision makers who care about controlling air pollution cannot make the best use of available resources.

Those decision makers will not find the answers in EPA's 1997 and 1999 reports to Congress. (One exception is EPA's separate analysis of provisions of the Act protecting stratospheric ozone, but this analysis suffers other problems.) EPA's Science Advisory Board (SAB) complained repeatedly that the reports failed to disaggregate costs and benefits. In its October 29, 1999 letter, SAB said that a "single overall, aggregate [benefit-cost] ratio has little practical relevance, since nobody is considering wholesale repeal of the [Clean Air Act]" (p. 10).

SAB also noted that it had "asked for disaggregation before and it has not yet been provided." The board concluded "it will not find the analyses in future prospective studies valid and reliable for their intended purpose without significant disaggregation by title and provision" (p. 11). In other words, without disaggregation, future EPA analyses will be no more useful than the 1999 report, which SAB found of "little practical relevance" (p. 10).

UNDERSTATED AND DUBIOUS COST ESTIMATES

Ignored Indirect Costs The 1999 EPA report excludes the indirect costs that arise when government actions exacerbate inefficiencies in labor and capital markets. Income taxes, for example, drive a wedge between workers' productivity and earnings. That wedge causes workers to supply less labor, resulting in efficiency losses. Air pollution regulations exacerbate efficiency losses by raising the prices of goods and services.

The indirect costs neglected by EPA are potentially large. SAB's letter suggests that the indirect costs could be 25 to 35 percent of direct costs (p. 15). EPA does not dispute the existence of indirect costs; instead, the agency tries to explain away its failure to account for them by alluding in its report to the "emerging nature of this literature" (p. 29). As we discuss later, EPA had no such qualms about its ability to estimate the benefits of air pollution controls.

Unvalidated Cost Estimates SAB did not examine the reliability of EPA's cost estimates. In fact, in its letter, SAB acknowledges having assumed that those estimates were reliable:

> It was not feasible to review all the input data used when computing direct costs. A good deal of the data are drawn from EPA's regulatory impact analyses, which presumably have undergone review; we assume such data to be reasonably reliable. (October 29, 1999, p. 8)

That assumption may be inappropriate. For example, EPA asserted that it would cost no more than $10,000 a ton to reduce emissions as required by the ozone standard (p. B-37). That assertion has no empirical basis. Moreover, the EPA report admits that, because the ozone standard cannot be met by currently identifiable control measures, progress may come about—if it is feasible at all—only through the adoption of measures that are not cost-effective (p. B-35).

Excluded Significant Costs Most importantly, EPA excludes the cost of meeting the provisions of Section 181 of the Clean Air Act (p. A-41). Section 181, which sets mandatory deadlines by which the states must meet the national ambient air quality standard for ozone, may be the costliest and most inefficient provision of the act. Documents in EPA's docket for its 1997 revision to the ozone standard reveal that five cities, including Los Angeles and San Diego, could not meet the standard even if they were to adopt all the emissions control measures that EPA can identify.

One way of estimating the full costs of compliance is to mimic EPA's usual method of assessing environmental risks. To estimate the unobservable risks of death and disease from low exposures to environmental hazards, EPA typically extrapolates the relationship between observable death and disease rates and high exposures. For a number of reasons, this method for assessing risks has little scientific merit. One reason is that individuals often have thresholds of exposure below which they do not experience adverse health effects. But there is no theoretical or empirical reason to assume, as EPA does, the existence of a threshold above which the incremental cost of controlling pollution would stop rising.

Using the method of extrapolation outlined in Randall Lutter's 1999 paper (see Readings), we estimate that it would cost $53 billion a year to meet EPA's ozone standard by 2010. Our estimate may well be too low. It excludes Houston and Galveston, Texas, which must cut nitrogen oxide emissions by nearly 70 percent to meet the ozone standard, according to the Texas Natural Resource and Conservation Commission. More recent scientific research indicates that the emissions cuts needed to meet air quality

standards may be much deeper than previously estimated. (See Winner and Cass, *Environmental Science & Technology* [2000].)

Thus, the total annual cost of meeting air pollution standards for 2010 is likely to be at least $100 billion a year, not the $27 billion a year estimated by EPA. The difference would still leave a net annual benefit of $6 billion—if one believed EPA's estimate of the gross annual benefit. But we don't.

EXAGGERATED BENEFITS

MORE THAN 90 PERCENT OF THE BENEFITS ESTIMATED BY EPA arise from the reduction of risks from particulate matter (PM). Those risks are highly uncertain, however, because scientific understanding of the health effects of PM is notoriously weak. According to the National Academy of Sciences, "There is a *great deal* of uncertainty about the implications of [epidemiological] findings for risk management" (p. 2, emphasis added). Apart from a handful of statistical associations, scientists generally have no direct evidence about the risks of low-level exposures to PM.

EPA's estimated reductions in PM-related health effects reflect only the statistical uncertainty associated with a single study by Pope and colleagues. Those researchers developed a statistical model of the association between mortality among about 200,000 people older than 35 years and outdoor concentrations of "fine particles" in 50 cities in the early 1980s. We focus here on three unsubstantiated assumptions made by EPA in its interpretation of the relationship that Pope and colleagues reported: (1) The reported association between PM and health effects is causal, (2) that causal relationship extends linearly to very low doses, and (3) the reported association is estimated using a correct model. We do not deal with other highly significant assumptions, including the assumption that the sample is unrepresentative.

Association and Causality Calculations based on the unproven assumption that an epidemiological association is causal overstate the best estimate. They ignore another benefit estimate based on the alternative (and also unlikely) assumption that the epidemiological association is not causal at all. Under this alternative assumption, EPA's estimate of total benefits declines tenfold. Simplification by neglect of the lower bound is misleading, but that may be the point. EPA knew that causality was unproven but still described its benefit estimate as "central."

Linear No-Threshold Dose-Response for PM EPA linearly extrapolated the association between PM and premature mortality reported in the Pope study to PM concentrations well below those actually observed. That procedure represents a hidden policy choice rather than a scientific imperative. Its validity cannot be confirmed or refuted scientifically, even where a biological theory strongly suggests that it is false.

The simple straight line is practically ruled out if individuals have exposure thresholds below which they do not experience adverse health effects. If thresholds in fact exist and relatively few people have high or low thresholds, then linear extrapolation exaggerates the population risks associated with low-level PM exposure.

This journal recently published an article arguing that the linear no-threshold model can give sensible results when applied to populations, even if individuals in the population are known to have dose thresholds (see Richard Wilson, "Regulating Environmental Hazards," *Regulation* (Vol. 23, No. 2). The author provides no supporting evidence that complex phenomena like population risk look linear rather than, say, S-shaped. As an example of nonlinear population dose-response relationships, consider the familiar example of alcohol consumption. Lethal doses surely vary among individuals but exposure sufficient to achieve a blood-alcohol concentration (BAC) of 0.50 grams per deciliter (g/dl) is probably lethal to 100 percent of the population. If the linear model worked for estimating population risks, then exposure sufficient to warrant a DWI citation (BAC greater than or equal to 0.10 g/dl in all 50 States and the District of Columbia) would also be large enough to kill one-fifth of all persons so exposed.

> Decisionmakers seeking to made the best use of scarce resources will not find answers in EPA's reports on the benefits and costs of the Clean Air Act.

To its credit, EPA departed from that assumption in the risk assessment for the PM standard it issued in 1997. The agency performed a sensitivity analysis showing that a plausible threshold lowered the population risk associated with PM exposures in Philadelphia County by a factor of between two and six. But EPA's reports to Congress do not acknowledge how thresholds in the relationship between air pollution and health would lower risk estimates and estimated benefits.

Validity of Statistical Model The results of a statistical model are valid only insofar as the model is valid; for example, omitting explanatory variables generally biases estimates of the relationship of interest. The statistical models used by Pope and colleagues may well display such bias. In the United States, measurements of personal exposure to PM are higher than ambient outdoor PM concentrations because of indoor sources of particles, such as cooking, smoking, cleaning, and other daily activities. Given that people spend a large majority of their time indoors, pollutants from

indoor sources may be the true culprit, or at least an active accomplice, in PM-related illness and deaths. Pollutants from indoor sources may be especially important for the chronically ill elderly, who spend nearly all their time indoors and for whom the observed epidemiological association with *outdoor* PM is strongest.

Weather affects exposure to pollutants from indoor sources. By increasing indoor-outdoor air exchange rates, greater average wind speed can lower indoor particle levels and thereby reduce personal exposure. A 1 percent increase in average wind speed is associated with a 1 percent increase in the rate that outdoor air is exchanged for indoor air, holding other things constant (American Society of Heating, Refrigeration and Air-Conditioning Engineers 1981). High air exchange rates reduce indoor particle levels, while low air exchange rates result in longer air residence time for fine particles and more opportunity for particle concentrations from indoor sources to increase. Researchers have found a negative relationship between wind speed and mortality, an observation consistent with that phenomenon. See, for example, Kalkstein and Davis (1989). Yet the epidemiological models linking ambient PM and mortality generally neglect both indoor PM exposure and wind speed.

Personal behavior also affects exposure to indoor pollutants. In more temperate climates, people spend more time outdoors and so reduce their total exposure to indoor PM. Pope and colleagues addressed the possible role of weather only by saying that "the association between pollution and mortality was not very sensitive to the inclusion of variables . . . for relatively hot or cold weather conditions" (p. 672). Those conditions, however, seem to be poor proxies for the meteorological phenomena that affect personal behavior. A better proxy for the propensity to spend time outdoors might be the number of daylight and evening hours that have low humidity and pleasant temperatures.

Could weather confound measurement of the association between PM and mortality? Yes, if cities with lower ambient outdoor PM and premature mortality also have stronger winds (which "clean out" indoor air pollution) and less rain, thereby encouraging more outdoor activities. As a preliminary test of this hypothesis, we regressed the PM concentrations used by Pope and colleagues on annual average wind speed and the number of days of precipitation of at least 0.01 inches. Both variables correlate with PM in the expected manner.

By failing to account for differences in wind speed, rain, or other determinants of intercity activity patterns, the analysis by Pope and colleagues appears to suffer from what statisticians call an "omitted variables bias." The practical effect of omitting such explanatory variables may be to exaggerate the risks posed by ambient outdoor PM. The Health Effects Institute considered a number of potentially omitted variables but not wind; though there is nothing to prevent the reanalysis team from considering wind in the future. No party other than HEI will conduct research accounting for behavioral patterns and indoor-outdoor exchange rates, because only HEI has access to the data of Pope and colleagues.

Overvaluing Reductions in Risk EPA also exaggerated benefits by using excessively large estimates of the value of reducing mortality risk. The studies underlying EPA's approach focus on 35- to 40-year old workers who generally expect to live another 40 years. Premature mortality from PM is associated with much older people, especially those with preexisting health conditions that impair their quality of life. Those persons may generally be willing to pay much less to reduce any given mortality risk because it has less effect on their life expectancy and does not restore good health. In its letter, EPA's Science Advisory Board clearly communicated that concern to the agency, stating that the values EPA assigned to reductions in premature mortality were "likely to be biased upwards"(October 29, 1999, p. 2). Thus, EPA's report exaggerates likely benefits by overestimating the likely magnitude of risk reduction obtained from PM controls and the likely values that beneficiaries would place on the risk reductions they presumably obtained.

> Regulators' self-evaluations are pernicious when Congress uses them to make policy decisions about how to improve regulatory programs.

QUESTIONS AND ALTERNATIVES

OUR FINDINGS PERMIT A STRIKING REASSESSMENT OF EPA'S estimates. The agency neglected both indirect costs and the costs of complying with Section 181 in developing its estimate of the costs for 2010. Adjusting EPA's estimate for those errors implies costs are about $104 billion in that year rather than $27 billion, just $6 billion short of EPA's "central" benefit estimate of $110 billion. This changes the benefit-cost ratio from 4.1 to 1.1. Thus the existence of any net social benefits is highly dependent on the implausible assumptions EPA used to derive its benefits estimate. While 90 percent of EPA's benefits rest on a dubious foundation of weak epidemiologic associations and heroic assumptions, technical corrections that reduced these benefits by just 6 percent could eliminate net benefits entirely.

The poor quality of EPA's reports to Congress raises a variety of fundamental questions. It is not surprising that EPA's air office succumbed to institutional incentives to make its programs look attractive. But how did the errors in the report survive the administration's internal quality

control procedures and SAB review?

EPA's internal oversight may have been ineffective because no one was given the authority to perform it. No firewall separated the reports' authors from air pollution program managers. In fact, the authors of the reports also developed the regulatory impact analyses for a number of major air pollution regulations and are among the air program's most avid defenders. They made the reports a justification for EPA's air program instead of a disinterested examination of the program or the effects of the Clean Air Act.

Adequate analytic capability exists elsewhere within EPA to detect and correct the reports' shortcomings, but there is no publicly available evidence that those resources were used in a disinterested manner. Senior staff outside EPA's air office knew, for example, that the cost of meeting the attainment deadlines set forth in Section 181 would be very high. Yet the agency continued to prepare a "comprehensive" report of the Clean Air Act that neglects this provision. If EPA's political management intended to monitor the air office to ensure a policy-neutral and informative report, its efforts failed.

Science Advisory Board More puzzling is the ineffectiveness of the review performed by EPA's Science Advisory Board. Although the board identified many serious limitations and defects in both reports at numerous points along the way, it concluded that the agency had "produced credible estimates" (p. 16). In requiring that the reports be peer-reviewed by SAB, Congress apparently expected the board to perform a quality control function. According to the record of critical letters SAB transmitted and EPA's limited efforts to address the board's concerns, SAB was unable to perform the quality control function that Congress apparently expected.

The best explanation for SAB's ineffectiveness may be malfunction of parts of the review process. The task set out for the SAB panel was more like supervising a student's doctoral dissertation than performing academic peer-review. SAB needed to determine whether EPA's reports were substantially correct, both in their underlying methodology and in their ultimate results. But effectively performing that task requires more involvement than SAB had.

No panel member had unique responsibility and authority for the quality of any particular section of the report. The arrangement departed from standard practice among dissertation committees, where the chairman is responsible for making a candidate successfully resolve material theoretical and empirical questions, and another member of the committee is typically responsible for supervising use of quantitative and statistical methods. Such specialization is particularly important with interdisciplinary research. Conforming to this model, EPA appointed experts to SAB in part for their diverse interests. Unfortunately, each board member lacked authority to reject those portions of the report that fell below relevant professional standards.

SAB also lacked authority to determine that the report failed to meet minimum professional standards. The report's publication was a foregone conclusion—it was statutorily required and subject to a judicial deadline. SAB could urge and cajole, but it couldn't say no. It's as if SAB had a student it couldn't flunk.

EPA's air office staff played a dominant role in the SAB review process. They controlled the flow of information to panel members, limited the time for the panel to review drafts and supporting documents, and structured the members' interaction. Public meetings where panel members could express their views were highly compressed and dominated by EPA staff presentations. In contrast, only the weakest dissertation committees allow Ph.D. candidates to dominate the process.

OMB Review A second layer of peer review conducted under the auspices of the Office of Management and Budget (OMB) did not fare well, either. Economists from several departments and agencies (including OMB and the Council of Economic Advisers) participated and quickly identified many serious defects in the report, much as they had when they reviewed EPA's 1997 report. The reviewers' efforts were frustrated by EPA staff, who refused to consider any material changes because the report had satisfied SAB. EPA used SAB as a shield to deflect legitimate criticism.

As the judicial deadline approached, federal agencies agreed only to disagree. EPA was forced to insert language into the report that distanced other departments and agencies (as well as the administration in general) from the text, thereby making the report an EPA rather than a government-wide document. EPA's 1997 report to Congress has similar language, but we know of no other precedent for such a stark disclaimer. Bureaucratic practice strongly militates against allowing sister government agencies to publicly draw lines in the sand, but the usual practice of glossing over differences was not followed here. In short, other departments and agencies were convinced that EPA's results were invalid and unreliable. And remarkably, it means the Clinton-Gore administration declined to support EPA's analysis and conclusions.

CONCLUSION

EPA'S REPORTS VIVIDLY ILLUSTRATE WHY GOVERNMENT regulatory agencies should not be asked to evaluate their own programs. While self-evaluations may be useful for improving internal management, they are pernicious when they become a basis for congressional or public views on substantive policy matters.

Congress should reconsider how to get authoritative, policy-neutral, and informative analysis of major programs. One possibility is to ask the National Academy of Sciences (NAS) to prepare such reports. The academy is widely regarded as more neutral and authoritative than any government agency. Of course, NAS also has its own rarely recognized limitations. First, the quality of NAS reports varies greatly depending on the composition of the panel—and especially who chairs it—and on the skills of the staff. Second, NAS panels can stray into policy matters where they

have no special expertise. There are no mechanisms to deter or prevent that from happening, in part because Congress frequently asks the academy to resolve controversial policy issues behind a façade of science. Third, NAS reports tend to be treated more authoritatively than they often deserve. Few scientists will publicly criticize an NAS report regardless of how unscientific it may be. Finally, because NAS would have to rely on critical information provided by EPA, it would need new procedures to ensure the validity and reliability of such information.

A second approach would be to establish within Congress the capacity to perform unbiased, authoritative analyses of major regulatory actions and programs. Efforts to establish a freestanding congressional office of regulatory analysis (CORA) have not been successful to date, but steps toward such an institution have been made despite persistent resistance. On July 25, the House of Representatives passed the Truth in Regulating Act of 2000 (H.R. 4924), which would direct the General Accounting Office to perform a three-year pilot project evaluating agencies' analyses of economically significant regulations. In addition to the challenges of successfully incorporating this function within GAO, its provisional nature would make it difficult to attract the top-quality staff necessary to mimic a permanent CORA. More generally, however, the success of any congressional office dedicated to regulatory oversight will depend on its independence from political pressures in Congress.

Independent oversight would help regardless of whether self-evaluations end. For example, Congress could direct OMB to perform and publish a formal, written review of the technical merits of each regulatory impact analysis. OMB staff have considerable expertise and a knack for quickly uncovering the most salient issues. But OMB reports to the same boss as EPA. While a changing of the guard might alleviate the problem, political interference will still be just a phone call away. A future CORA also could perform independent reviews of agency analyses. Scholars in various universities and think tanks could also be called on to provide independent reviews, though their institutional and personal interests would preclude complete neutrality.

Which type of oversight is best? We believe that the limitations of each type of oversight and the obvious need for a lot more of it warrant greater use of all of the above institutions. Competition can't hurt and will surely help.

Congress should refrain from directing regulatory agencies to evaluate their own actions. Instead, Congress should direct policy-neutral institutions that are independent of regulatory agencies and protected from political interference to perform such evaluations. Meanwhile, OMB and CORA (should such an office be established) ought to perform formal reviews of all agency self-evaluations. Finally, the recent ascendance of nongovernmental third-party oversight institutions offers a unique opportunity for Congress and the public to acquire information that governmental agencies do not provide. Such reforms will weaken EPA's incentive to disregard legitimate criticism and deter it from publishing uninformative analyses that lack credibility. Isn't that, after all, what Congress intended?

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