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NOT CONSIDERING COSTS IN SETTING NAAQS: A Costly Mistake

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1. Introduction

The Clean Air Act in its present form is a 465-page document that is complex and opaque. A primary stated goal of the Clean Air Act is to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population."[2] A variety of air pollutants are regulated by the Environmental Protection Agency (EPA) under the six titles of the Clean Air Act. Some of these titles expressly grant the EPA the authority to consider implementation costs in considering its regulatory actions. Notably, however, the EPA Administrator may not consider implementation costs in setting National Ambient Air Quality Standards (NAAQS), an interpretation of the Clean Air Act that was upheld in a 2001 Supreme Court ruling.[3] The EPA must establish ambient air quality standards for each air pollutant that "cause[s] or contribute[s] to air pollution which may reasonably be anticipated to endanger public health or welfare."[4] The primary guideline EPA has in setting NAAQS is that it must set a standard that protects human health and allows "an adequate margin of safety."[5]

Some have cited EPA's inability to consider costs as a victory for human health and welfare. The reality is quite the opposite: Setting NAAQS without considering costs could eventually lead to scenarios where EPA policies actually reduce human health and welfare. Every time EPA sets a new ambient air quality standard, the resources devoted to compliance with the new standard are taken away from other uses. The allocation of scarce resources in the economy is forcefully altered, with more resources devoted to clean air activities at the expense of other investments. While improving air quality can impart health benefits, so can investing in health care research, buying safer cars, paving potholes, or reducing childhood diabetes. When considering the promulgation of new regulations under the Clean Air Act, EPA should consider the costs of its actions and choose whichever action is most beneficial to society. Sometimes, the most beneficial action may be not to create a regulation and instead allow the resources that would have been used for compliance to be used in other activities. Amending the Clean Air Act to state that the EPA Administrator should consider implementation costs in setting NAAQS would allow the Administrator to carefully consider whether EPA's regulatory actions indeed improve human health and welfare. Tools for economic analysis of regulations such as benefit-cost analysis, cost-effectiveness analysis, and risk-risk

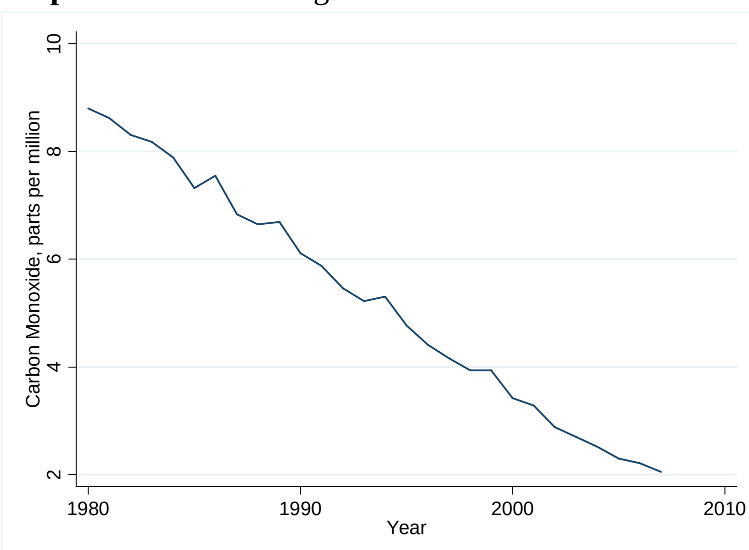
[1] Email: pmclaug3@gmu.edu
[2] Clean Air Act, §101(b)(1).
[3] Whitman et al. v. American Trucking Associations, Inc. et al. No. 99-1257. Decided February 27, 2001.
[4] Clean Air Act, §108(a)(1)(A); §109(b)(1).
[5] Clean Air Act, §108(b)(1).

analysis all would help EPA in making its regulatory decisions. However, all those tools require that the EPA be empowered to consider costs when setting NAAQS.

2. Background on the Clean Air Act

The political process that has created the current version of the Clean Air Act and other environmental legislation over the past four decades has led one previous EPA Administrator, Alvin Alm, to compare the legislation to an archaeological dig, wherein "[e]ach layer represents a set of political and technical judgments that do not bear any relationship to other layers."[6] Another former Administrator, William Ruckelshaus, stated that EPA suffers from "battered agency syndrome… not sufficiently empowered by Congress to set and pursue meaningful priorities, deluged in paper and lawsuits, and pulled on a dozen different vectors by an ill-assorted and antiquated set of statutes."[7] The sentiments of these former Administrators are regularly echoed by regulators, academics, and environmental practitioners, some of whom have called every incarnation of the Clean Air Act since 1967 "overly cumbersome," "peculiarly complex and obscure," and "opaque."[8]

Graph 1. National average carbon monoxide concentrations over time.[9]



Despite the complexity and obscurity of the Clean Air Act and the difficulties of the EPA in administering it, air quality has improved. As of 2007, the concentrations of the six common air pollutants (or criteria pollutants) for which EPA sets national air quality

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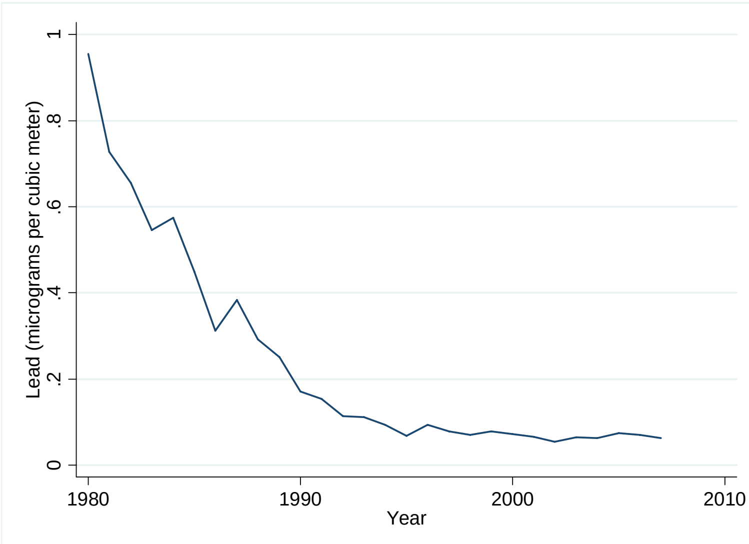
[6] Alm, Alvin. U.S. EPA. 1990. *EPA Journal* 13 (September/October). Washington, DC.: U.S. EPA. Quoted in Morgenstern, Richard, editor. *Economic Analysis at EPA: Assessing Regulatory Impact*. 1997. Washington, D.C.: Resources for the Future. p. 10.
[7] Ruckleshaus, William D. 1995. Speech at the Environmental Law Institute, October 18. Quoted in Morgenstern, *supra note* 1. p. 12.
[8] Morriss, Andrew P. 2000. "The Politics of the Clean Air Act." Chapter in *Political Environmentalism: Going Behind the Green Curtain*, edited by Terry L. Anderson. Stanford: Hoover Institution Press. pp 264-265.
[9] US Environmental Protection Agency. Air Trends Basic Information. Washington, D.C.: US EPA. Available online: http://www.epa.gov/air/airtrends/sixpoll.html. Accessed on Nov. 14, 2008.

standards had decreased significantly compared to both 1980 and 1990.[10] For example, according to EPA data and shown in Graph 1 above, by 2007 the amount of carbon monoxide in the air had decreased by 76 percent compared to 1980, and by 67 percent since 1990. Airborne lead has decreased by 94 percent since 1980 and by 78 percent since 1990 (see Graph 2 below). In fact, the air concentrations of all the criteria pollutants (carbon monoxide, ozone, lead, nitrogen dioxide, particulate matter, and sulfur dioxide) have decreased by more than 20 percent since 1980 even while the economic activities that create some of those pollutants have increased.[11]

Graph 2. National average airborne lead concentrations over time.[12]



If air quality has improved under the Clean Air Act, then why have so many involved in environmental regulations bemoaned its shortcomings, even to the point where an EPA Administrator has proposed rewriting the Clean Air Act?[13]

The answer is simple: the Clean Air Act may not be cost-beneficial, or even cost-effective, in improving overall human health and welfare. While it is possible that at least some of the improvement in air quality may be due to the Clean Air Act, other factors—such as technological innovation, the threat of lawsuits, and consumer demand for environmentally friendly goods and services—may have contributed to air quality improvement as well. In fact, the downward trend for many pollutants may actually predate federal controls for those pollutants, indicating other forces at work besides federal regulations.[14] Nevertheless, even if it is assumed, for the sake of argument, that the improvements in air quality are entirely attributable to the Clean Air Act, it remains

[10] Ibid.
[11] Ibid.
[12] Ibid.
[13] Eilperin, Juliet. 2008 "EPA Tightens Pollution Standards." *Washington Post*. March 13.
[14] Morriss, Andrew P., *supra note* 8; Goklany, Indur. 2000 "Empirical Evidence Regarding the Role of Federalization in Improving U.S. Air Quality." *The Common Law and the Environment*, edited by Roger Meiners and Andrew P. Morriss. Lanham, Md.: Rowman & Littlefield.

possible that the resources devoted to improving air quality under the Clean Air Act could have improved human health and welfare to a greater degree in alternative investments. Furthermore, even if the Clean Air Act has been relatively cost-beneficial or cost-effective so far, future regulation under the Clean Air Act may generate scenarios where society is actually made worse off than it would be without the regulation.

2. Assessing the Clean Air Act

Many regulations promulgated by EPA generate considerable costs and thus require some portion of society's limited resources. For regulations promulgated under the Clean Air Act, these costs are usually expended in an effort to avert adverse human health effects, such as asthma or lung cancer. The same resources that are utilized in complying with Clean Air Act regulations could potentially be used in other activities that would improve human welfare. One relevant question, therefore, in deciding whether the Clean Air Act is a success is: Could the resources used to comply with the Clean Air Act be better used elsewhere in society?

There are obviously many difficulties that arise in attempting to determine whether the resources used for Clean Air Act compliance could be better used elsewhere in society. The first is defining exactly what "resources used to comply with the Clean Air Act" means. The resources used for Clean Air Act include any direct compliance costs that arise from regulations—such as the costs that EPA terms "operation and maintenance costs." Direct compliance costs include research and development expenditures and capital costs. The resource cost of Clean Air Act compliance also includes a host of indirect costs, such as undertaking legal and lobbying actions for and against further regulation; production, trade, and consumption forgone as a result of decreased economic activity in the regulated industries; and even decreases in economic activity in seemingly unrelated industries, as the effects of higher costs in one industry ripple through the entire economy. The total costs for an economy of compliance with regulations are always greater than the direct costs to the regulated industry itself. When general equilibrium effects are taken into account, industries and individuals seemingly unrelated to the regulated industries can be negatively affected by environmental regulations.[15]

A common misconception about the costs of environmental regulations is that their costs fall only on polluters. This is false. Some costs certainly are borne by emitters of air pollutants, but ultimately all of society pays some of the costs of compliance with the Clean Air Act.

Secondly, before deciding whether the Clean Air Act is a success, the goal of the Clean Air Act should be better understood. The goal of setting NAAQS is to improve human health and human welfare.[16] As mentioned previously, the Clean Air Act directs the EPA Administrator to set NAAQS at a level that protects human health "allowing an adequate

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[15] Hazilla, Michael and Raymond J. Kopp. 1990. "Social Cost of Environmental Quality Regulations: A General Equilibrium Analysis." *Journal of Political Economy*. 98, 4, pp. 853 – 873.
[16] Clean Air Act, §108(a)(1)(A).

margin of safety."[17] The Administrator is prohibited from considering the costs of compliance when setting NAAQS.[18] Prohibiting the consideration of costs could lead to the creation of ambient air quality standards that, on net, harm human health and welfare, rather than enhance them. Thus, failing to consider costs could undermine the very goal of the Clean Air Act, the improvement of human health and welfare. Instead of prohibiting the consideration of costs, regulators would better serve the public interest by considering as much information about the effects of a rule as possible. The following section details some of the types of analysis that the EPA Administrator could apply if costs were considered, including benefit-cost analysis, cost-effectiveness analysis, and risk-risk analysis.

3. Types of regulatory analysis

At least three relevant standards could help decide whether a regulation harms or helps human health and welfare. The first is the standard economist's tool, benefit-cost analysis. Benefit-cost analysis weighs the overall benefits of a variety of policy choices against their overall costs. This standard has been applied in most federal regulation of human health and welfare. A closely related sort of analysis is cost-effectiveness analysis, which assesses ways of achieving a fixed goal. A third type of analysis by which a regulation can be assessed is called risk-risk analysis. Risk-risk analysis recognizes that a regulation that reduces health risk of one sort may increase health risk of another sort. One form of risk-risk analysis is called health-health analysis. Health-health analysis highlights the relationship between health and wealth. Regulations that attempt to decrease health risk may simultaneously decrease private expenditures on other health risk reducing activities, a tradeoff studied in health-health analysis.

3.1 Benefit-cost analysis

A benefit-cost analysis attempts to monetize all relevant costs and benefits of policy options. There are necessarily ranges of uncertainty, and sometimes it can be impossible to monetize certain costs or benefits. Nevertheless, subjecting regulations to benefit-cost analysis would help inform policymakers, regulators, and the public about the choices they make. Creating a costly regulation necessarily entails sacrificing some other economic activity. In some cases, the benefits of a regulation may be so large that it is worthwhile to create the regulation and sacrifice the benefits of activities forgone; in other cases, the costs may so greatly outweigh the benefits that regulators would decide against creating the regulation.

Benefit-cost analysis tries to determine the value of regulatory outcomes to consumers, typically through revealed preferences or contingent valuation. Regulations promulgated under the Clean Air Act should attempt to improve human health and welfare as a primary goal. Thus, those regulations' benefit-cost analyses typically include monetized improved health outcomes anticipated to occur because of the regulation. For example, EPA's most recent regulatory impact assessment on revising the NAAQS for lead

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[17] Clean Air Act, §108(b)(1).
[18] Whitman et al v American Trucking Association et al, *supra note* 1.

included estimates of the adverse health impact of high blood lead levels on the cognitive function of children. The calculated monetized benefits of each hypothetically avoided case were included as benefits in its benefit-cost analysis.[19] On the other hand, costs of a regulation include direct costs, such as the engineering, operations, and maintenance costs of adding pollution controls to a factory, as well as indirect costs, such as the opportunity cost of capital devoted to compliance with the regulation. In other words, benefit-cost analysis helps regulators and policymakers select regulations and policies with positive net social benefits. Furthermore, benefit-cost analysis can help identify areas of uncertainty on the costs and benefits of different policies and areas where new information may be valuable in evaluating policies.[20]

Many economists in the government, academia, and the private sector have applied benefit-cost tests to federal regulations. One relatively recent and thorough paper on the subject of the costs and benefits of federal regulations estimates that of the 76 final regulations studied for the paper, 32 did not pass a benefit-cost test, meaning that nearly half of the regulations analyzed in the paper cost society more than they benefited society.[21] In fact, many regulations are promulgated even after they fail to pass benefit-cost tests in the government's own regulatory impact analyses—economic analyses of the impact a regulation would have on the economy if promulgated. For example, when EPA revised the NAAQS for ozone in 1997, EPA published a regulatory impact analysis that estimated the net benefits of full attainment of its proposed ozone standard would produce "net benefits ranging from negative $1.1 billion to negative $8.1 billion" in 1990 dollars.[22]

This is not to suggest that benefit-cost analyses should be the only justification needed for creating a new regulation. Instead, benefit-cost analysis can be used to inform all relevant parties about the consequences of taking a certain action, so that the action can be compared to alternatives.

3.2 Cost-effectiveness analysis

An alternative to benefit-cost analysis is cost-effectiveness analysis. To some degree, cost-effectiveness removes subjective judgment from the analysis. While benefit-cost analyses' results may vary depending on the costs considered, discount rates, and beliefs about technological innovation, cost-effectiveness analysis simply compares the cost of different ways of achieving some fixed goal. For EPA regulations, one easily understood and comparable goal is the cost of a statistical life saved.

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[19] US Environmental Protection Agency. 2008. "Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Lead." Washington, D.C.: EPA. Available online: http://www.epa.gov/ttn/ecas/regdata/RIAs/finalpbria.pdf

[20] Hahn, Robert W. and Patrick Dudley. "How Well Does the Government Do Cost-Benefit Analysis?" AEI-Brookings Joint Center for Regulatory Studies Working Paper 04-01. April 2005.

[21] Morrall, John. 2003. "Saving Lives: A Review of the Record." *Journal of Risk and Uncertainty*. 27, 221 – 237.

[22] US Environmental Protection Agency. 1997. "EPA's Regulatory Impact Analyses (RIA) for the 1997 Ozone and PM NAAQS and Proposed Regional Haze Rule." Washington, D.C.: EPA. p. ES-20. Available online: http://www.epa.gov/ttn/oarpg/naaqsfin/ria.html

As noted earlier, the Clean Air Act mandates that the EPA Administrator should set NAAQS for air pollutants that endanger public health or welfare. Statistical lives saved is a health outcome that regulators typically cite as evidence of a regulation's benefits. For example, according to EPA, particulate matter can cause premature death in individuals with heart or lung disease.[23] Reducing the concentration of particulate matter in the air may therefore avert some of those premature deaths. Incorporating scientific and medical studies on the effects of the criteria pollutants on human health, analysts statistically model the number of human lives that would be saved by full or partial compliance with the regulation.

Because most major environmental regulations created since 1981 include some estimate of statistical lives saved, it is possible to review those regulations and determine how much each regulation costs per statistical life saved. Table 1 (on the next page) presents a summary of three reviews' findings, sorted in ascending order of the average of the cost estimates for each regulation. For some regulations, all three reviews produced an estimate of the cost per statistical life saved. For others, only one or two of the reviews produced an estimate.

The estimates of the cost per life saved clearly vary both across regulations and across the years. The average estimated cost per life saved ranges from $4.8 million (in 2000 dollars) to $67.7 billion. There is also significant variation in the estimates of the costs per life saved of individual regulations across the studies themselves. However, the bulk of that variation occurs for very high-cost regulations (greater than $20 million per statistical life saved) while the other estimates display remarkable consistency across the studies.

Table 1 is particularly useful in understanding the opportunity cost of environmental regulations. Allowed to consider information on the costs of implementing regulations, policymakers would be better able to decide where to allocate scarce resources. This is the benefit of considering cost: knowing that a regulation may cost, for example, many billions of dollars per statistical life saved could induce regulators to rethink promulgating such a rule. Allocated elsewhere, those billions of dollars may be much more cost-effective and save more lives per invested dollar.

[23] US Environmental Protection Agency. "Particulate Matter: Health and Environment." Available online: http://www.epa.gov/air/particlepollution/health.html

Table 1. Cost per statistical life saved of environmental regulations, millions of 2000 $.[24]

Regulation	Year	Hahn et al.	Morrall	Viscusi et al.	Average
Benzene NESHAP (original: fugitive emissions)	1984	5		4.6	4.8
NOx State Implementation Plan (SIP) call	1998		5.7		5.7
Ethylene dibromide in drinking water	1991		5.7	7.7	6.7
Benzene NESHAP (revised: coke by-products)	1988		6.1	8.2	7.2
Standards for radionuclides in uranium mines	1984	11	6.5	4.6	7.4
Arsenic emission standards for glass plants	1986		18	18.2	18.1
Arsenic/copper NESHAP	1986		25.6	31	28.3
Hazardous waste listing of petroleum refining sludge	1990		27.5	37.2	32.3
Cover/move uranium mill tailings (inactive)	1983		26.5	42.6	34.6
National prim. & sec. drinking water regs. Phase II	1991	28	47.4		37.7
Benzene NESHAP (revised: transfer operations)	1990		33.2	44.3	38.7
Cover/move uranium mill tailings (active sites)	1983		50.2	60.6	55.4
Asbestos ban	1989	21	73.9	148.9	81.3
Benzene NESHAP (revised: waste operations)	1990		170.6	226.2	198.4
Land disposal restrictions for third scheduled waste	1990	215			215
Sewage sludge disposal	1993	215	502.4		358.7
Hazardous waste: solids dioxin	1986	226	530.8		378.4
1,2-dichloropropane in drinking water	1991			878.4	878.4
Land disposal restrictions, Phase II	1994	1,030	2,464.5		1,747.2
Hazardous waste land disposal ban	1988	452	1,042.7	5,636.9	2,377.2
Drinking water: phase II	1992	10,800	18,009.5		14,404.7
Municipal solid waste landfills	1988			25,702.6	25,702.6
Atrazine/alachlor in drinking water	1991			123,851.4	123,851.4
Solid waste disposal facility criteria	1991	40,700	94,786.7		67,743.4

[24] Table 1 sources: Hahn, Robert W., Sheila M. Olmstead, and Robert N. Stavins. 2003. "Environmental Regulation in the 1990s: A Retrospective Analysis." *Harvard Environmental Law Review*. 27, 377 – 415. p. 379.
Viscusi, W. Kip, Jahn K. Hakes, and Alan Carlin. 1997. "Measures of Mortality Risk." *Journal of Risk and Uncertainty*. 14, 228-29.
Morrall, John, s*upra note* 21.

3.3 Risk-risk analysis

The third standard used to decide whether a regulation harms or helps human health and welfare has been termed risk-risk analysis, and one general form of risk-risk analysis that is relevant to setting NAAQS is health-health analysis.[25] Risk-risk analysis offers an alternative to converting "health outcomes into a monetary metric" such as occurs in benefit-cost analysis.[26] Instead, risk-risk analysis studies the important risk tradeoffs that may exist when setting the levels of risk regulations. A clear policy objective when creating regulations that are designed to reduce risk should be that the regulation actually reduces overall risk. In this sense, it is a lower bar for a regulation to clear as an increase in risk is also a cost. Thus, a broad consideration of all costs would include risk increases as just one type of cost. Just as with using overall costs as the criteria, when "one is solely concerned with risk reduction, it will not always be desirable to set risk regulations at their most stringent level."[27]

One example of a risk-risk tradeoff is when a policy poses multiple risks. For example, saccharin, an artificial sweetener, was considered by FDA in the 1970s as a potential carcinogen, and FDA at one point sought to ban the product outright. Banning it in order to reduce cancer risk, however, might have led to an increase in a different sort of health risk—obesity.[28] This is because saccharin is a relatively low-calorie substitute for sugar, and without saccharin available, some individuals may use sugar or other high-calorie sweeteners. A second type of risk-risk tradeoff occurs when a policy or regulation induces changes in behavior. A classic example includes mandatory airbags in cars. Some individuals may drive faster in cars equipped with airbags, apparently because they feel more secure. As a result, while some health risks may be reduced for the driver of the airbag-equipped vehicle, those risk reductions come at the cost of an increase in health risk for pedestrians and motorcyclists.[29] A third type of risk-risk tradeoff occurs when regulatory expenditures lead directly to increases in risky economic activities. For example, some injuries and deaths may occur in the process of manufacturing and installing pollution control equipment that was required by an environmental regulation.[30]

Another type of risk-risk tradeoff has been termed "health-health tradeoff." When regulations take resources away from other uses, individual health and welfare may be negatively affected because of a necessary reduction in spending on other goods and services. Health-health analysis points to a relationship between wealth and health, where health is measured by mortality risk and morbidity risk. As Lutter and Morrall point out in their 1994 article,

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[25] Lutter, Randall and John Morrall. 1994. "Health-Health Analysis: A New Way to Evaluate Health and Safety Regulation." *Journal of Risk and Uncertainty*. 8, 43 – 66.
[26] Viscusi, W. Kip. 1994. "Risk-Risk Analysis." *Journal of Risk and Uncertainty*. 8, 5 – 17. p. 5.
[27] Ibid., p. 1.
[28] Ibid., p. 2.
[29] Miller, Roger LeRoy, Daniel K. Benjamin, and Douglass C. North. 2005. *The Economics of Public Issues, 14th Edition*. Boston: Pearson Addison-Wesley.
[30] Viscusi, W. Kip, *supra note* 26. p. 6.

> Compliance with costly regulations affects the consumption of risk-reducing goods and services in the same way as a wealth decline. Spending on compliance necessarily reduces the resources that may be spent on all other goods and services. The effective size of the [economic] pie being smaller, less of it is put to the purchase of health and safety.[31]

This is the health-health tradeoff—regulations aimed at reducing some health risk may simultaneously increase some other health risk by inducing a reduction in the consumption of health risk-reducing goods and services. Because efforts to reduce target risk in one area may lead to increases in other health risks, there can be a mortality cost resulting from regulatory actions, and that cost itself can outweigh the benefits of a regulation. Furthermore, health-health analysis paints a sometimes bleak picture of the reality of some regulations: costly regulations, regardless of their intention, can sometimes induce fatalities. As described by former OMB economist John Morrall, this health-health tradeoff may lead to situations where the reduction in consumption of health risk-reducing goods and services costs lives:

> [A] key cutoff point [for assessing regulations] is where cost-ineffective regulations do more harm than good. Because resources are used to produce the benefits of risk reducing regulation, there is an opportunity cost to spending that can be measured in risk reduction. […] In 2002 dollars, [Lutter, Morrall, and Viscusi's] estimate is that a diversion of $21 million induces one fatality.[32]

Even if one does not believe that benefit-cost analysis is relevant to environmental regulations, health-health analysis indicates that in some cases environmental regulations could result in a net decrease in health although the regulations' were presumably created to increase health.

Morrall finds that 27 of the 76 regulations studied in his 2003 paper cost more than this cutoff of $21 million per statistical life saved, and therefore "cause more harm than good."[33] In other words, the cost of reducing mortality risk of some activity (such as drinking contaminated water), through regulation, sometimes actually *increases* mortality risk because of offsetting decreases in other activities, such as health care consumption. Morall points out that, although 70% of the EPA regulations he studied were cost-ineffective using the $21 million cutoff, "[o]ne should not generalize… that, in particular, environmental regulations as a whole are cost-ineffective." Some EPA regulations may indeed have been cost effective. Rather, the point is that risk-reducing regulations, which Clean Air Act regulations generally are, may in fact be risk-increasing. Careful analysis prior to the enactment of a new regulation and ongoing study of its effects after a regulation's promulgation can help regulators and policymakers understand whether that is the case. Unfortunately, EPA's ability to use this type of analysis prior to setting an ambient air quality standard is severely restricted.

[31] Lutter and Morrall, *supra note* 25, p. 44.
[32] Morrall, John, s*upra note* 21, p. 232.
[33] Ibid., p. 232.

Returning to the Clean Air Act and EPA's inability to consider costs in setting NAAQS, two of the criteria pollutants that are regulated under the Clean Air Act are ozone and particulate matter. EPA established an ozone standard and a particulate matter standard in 1971, and ozone and particulate matter concentrations in the air have decreased over the past few decades.[34] Pursuant to the Clean Air Act, NAAQS for all criteria pollutants are reviewed every five years.[35] The ambient air quality standard for particulate matter was revised in 1987, 1997, and 2006. For ozone, the standard was revised in 1979, 1997, and 2008. Achieving further reductions in both particulate matter and ozone are certain to become more costly per unit of pollutant as the ambient air quality standards are made more stringent. This reflects the economic principle of increasing marginal costs. Eventually, there must come a point where the cost of a further reduction in a unit of particulate matter, lead, ozone, or any criteria contaminant is greater than the benefits of that reduction. Under the current interpretation of the Clean Air Act, however, the EPA Administrator cannot even consider whether costs may outweigh benefits. Additionally, ozone and particulate matter appear to be nonthreshold pollutants—there is likely no specific level at which scientists could state, with certainty, that they posed no health risk. As a result, every so often, during a mandatory review of the NAAQS for ozone and particulate matter, EPA may tighten up the standards, regardless of whether that tightening results in tremendous economic costs and only miniscule benefits. Under the current law, the possibility of achieving any public health benefit, no matter how tiny, is the only hurdle EPA must clear in order to set a more stringent NAAQS, and costs do not matter.

Prior to allocating the limited resources of an economy to compliance with environmental regulations, EPA should consider the costs of achieving the stated goal of the regulation and whether that goal could be more efficiently realized. As a leading text on regulation put it, ". . . regulatory agencies should be cognizant of the harm that is done when they fail to take costs into account. The concern of economists with cost is not a professional bias, but ultimately has a link to individual welfare."[36]

4. Future regulatory choices under the Clean Air Act

Despite the EPA's inability to consider costs in setting NAAQS, it is still possible that Clean Air Act regulations have produced positive net benefits up to this point. EPA has produced their own benefit-cost analyses of Clean Air Act overall and concluded that between 1970 and 1990 the benefits of the Clean Air Act totaled between $5.6 trillion and $49.4 trillion, while the direct costs were only $523 billion.[37] Some have doubted the EPA study's validity, questioning EPA's methods and assumptions.[38] Regardless of the

[34] US Environmental Protection Agency, *supra note* 9.
[35] Clean Air Act, §109(d)(1).
[36] Viscusi, W. Kip, Joseph E. Harrington, and John M. Vernon. 2005. *Economics of Regulation and Antitrust, 4th Edition*. Cambridge: MIT Press.
[37] US Environmental Protection Agency. 1997. *The Benefits and Costs of the Clean Air Act, 1970 to 1990*. Washington, D.C.: EPA. Available online: http://www.epa.gov/air/sect812/copy.html
[38] For example, see Hahn, Robert W. 2000 "The EPA's True Cost." Washington, D.C.: AEI Online. Available online: http://www.aei.org/publications/pubID.6699/pub_detail.asp.

study's validity, the very fact that air pollution levels have decreased so dramatically over the last few decades means that it is increasingly likely that we have reached or will soon reach the point where marginal costs of additional improvements will exceed marginal benefits. As the authors of one review of the influence of economics on environmental policy-making in the 1990s point out,

> Emissions of many air and water pollutants declined dramatically from 1970 to 1990, when the "low-hanging fruit" among air and water quality problems were being addressed. For example, air emissions of lead, which declined significantly due to the shift to unleaded gasoline (completed in 1987), saw little further improvement during the 1990s.[39]

Importantly, the validity of the EPA's benefit-cost analyses of regulations previously promulgated under the Clean Air Act means very little when it comes to deciding whether to create new regulations. The regulations promulgated so far under the Clean Air Act may or may not have produced positive net benefits, but because of increasing marginal costs and diminishing marginal benefits of air quality, at some point further regulation under the Clean Air Act will be more costly than beneficial. Instead of relying on historical estimates, regulators should ask: What additional costs will be expended to achieve a higher level of air quality, and what are the additional benefits of doing so? Or, again, as an alternative to monetizing costs and benefits, cost-effectiveness could be considered: How many statistical lives will be saved, and at what cost per statistical life?

Performing benefit-cost analyses in hindsight by aggregating the effects of regulation over a twenty year period, such as in the EPA report, does not inform regulators about the cost and benefit of additional regulation. For this, each regulation must be individually examined, both before and after its promulgation, as the costs and benefits of implementing it could differ severely from those of regulations promulgated in the past.

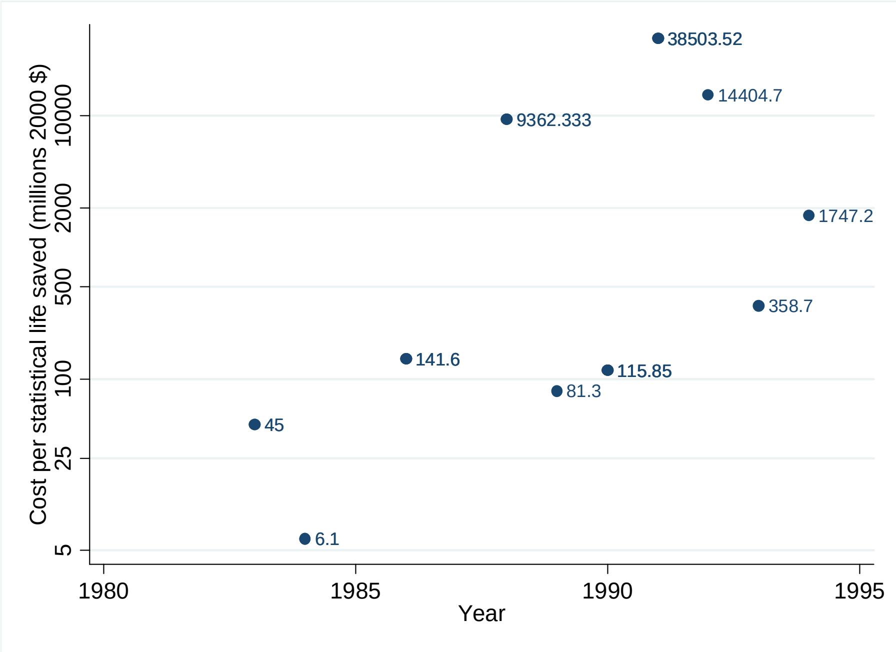
Graphically examining the data presented in Table 1 illustrates the important concept of increasing cost per statistical life saved of environmental regulation. The first is that environmental regulations, overall, are becoming increasingly costlier per statistical life saved. The graph below plots the yearly average estimate of the cost per statistical life saved for every regulation that was reviewed by two or more of the studies listed in Table 1. For example, three environmental regulations promulgated in 1986 were listed in Table 1. The average estimates of the cost per statistical life saved for each of the three regulations were $18.1, $28.3, and $378.4 million. Averaging those three numbers yields $141.8 million, which is plotted as the average cost per statistical life saved for regulations promulgated in 1986.

Examining the graph, there appears to be a clear upward trend in the cost per statistical life saved as additional environmental regulations are promulgated over time. This is a demonstration of increasing marginal costs although it is admittedly crude for a couple of reasons. For one, the regulations reviewed may not be a good representative sample of all EPA regulations. Also, increasing marginal cost of environmental cleanup should occur

[39] Hahn et al, *supra note* 24.

in a world where all other relevant factors, including technology, are held constant. Over the timeframe shown in the graph, technology has certainly advanced considerably, but that only serves to emphasize just how costly environmental regulations can be. The fact remains that environmental regulations have cost increasingly more per statistical life saved despite increases in technology.

Graph 3. Cost-effectiveness of some major EPA regulations on logarithmic scale



If the EPA Administrator continues to be unable to consider costs in setting NAAQS, then society will eventually be made worse off, if that has not occurred already. The costs of compliance with stricter and stricter regulations, including those costs that go into development of new pollution control technologies and monitoring pollution output, may eventually increase. The resources used to comply with additional regulations could be used elsewhere, and if the alternative uses present greater benefit than that of stricter air quality regulations, then government will have failed its constituents.

5. Conclusion

One way to help prevent a scenario wherein the setting of a NAAQS makes society worse off is to simply amend the Clean Air Act. Specifically, Congress should amend the Clean Air Act to state that the Administrator should consider the costs of compliance, including risk-risk tradeoffs and opportunities forgone, when setting NAAQS. Such an action would allow EPA to actually use the tools that are already at its disposal to help inform its regulatory decisions. Benefit-cost analysis, cost-effectiveness analysis, and risk-risk analysis are just a few of the tools could help regulators make decisions that are more likely to benefit society, and to avoid options that make society worse off.