ENVIRONMENTAL REGULATION DURING THE 1990S: A RETROSPECTIVE ANALYSIS

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January 27, 2003

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ABSTRACT

We carry out a retrospective analysis of environmental regulation in the 1990s by examining environmental and resource policy making during the decade from the perspective of economics. We focus on the Clinton Administration, and highlight important trends and changes in the impacts of economic thinking. We begin with a review of environmental quality changes during the 1990s, and then focus our discussion around three themes: efficiency, cost-effectiveness, and distributional equity. We highlight the ways in which the role of efficiency as a criterion for assessing environmental and natural resource rules and regulations was very controversial in the Clinton Administration, while efficiency emerged as a central goal of the regulatory reform movement in the Congress. We examine how cost-effectiveness was embraced by both the Administration and the Congress in the 1990s as a criterion for adopting specific policy instruments. And we analyze how and why the decade witnessed an increasing role for equity concerns as a consideration in environmental policy-making.

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ENVIRONMENTAL REGULATION DURING THE 1990S: A RETROSPECTIVE ANALYSIS

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1.0 INTRODUCTION

The attention given to environmental and natural resource issues in the United States has grown over the past several decades, a period during which greater consideration has been given to the efficiency, cost-effectiveness and distributional equity of laws and regulations intended to protect the environment or improve natural resource management.[1] Although several of the major environmental statutes are ambivalent about the role of economic analysis, in some cases prescribing it, in others proscribing it, a series of Presidential executive orders has called for a larger role for economic analysis of environmental and resource policies.

Administrations can have substantial influence over the application of economics to environmental policy through a variety of mechanisms. The conventional wisdom in the United States is that Democratic administrations are predisposed toward more active environmental

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[1]We follow the standard definition of an *efficient* environmental policy as being one which involves a target – such as a 50 percent reduction in sulfur dioxide (SO_2) emissions – that maximizes the difference between social benefits and social costs, i.e., a target level at which marginal benefits and marginal costs are equated. By *cost-effective* policies, we refer to those which take (possibly inefficient) targets as given by the political process, but achieve those targets with policy instruments – such as a tradeable permit system in the SO_2 case – that minimize aggregate costs. Assessments of the *distributional* implications of environmental policies include analyses of the distributions of costs and benefits.

regulation, and less inclined toward economic analysis of environmental policy than their Republican counterparts. The Clinton Administration (1992-2000), for example, is widely perceived to have been predisposed to environmental quality and resource preservation, and less supportive of economic analysis of such issues, in comparison with its Republican predecessor and successor (the administrations of George H. W. Bush and George W. Bush, respectively).

In fact, environmental and natural resource policy in the 1990s was characterized by continuity and by change. Two important trends that began in the 1970s continued through the 1990s — environmental targets were made more stringent, and environmental quality improved. In some cases, these improvements can be linked directly to Federal policies and regulations; in others, such linkage has yet to be established. Most important among the new targets were the 1997 National Ambient Air Quality Standards (NAAQS) for ambient ozone and particulate matter, which could turn out to be one of the Clinton Administration's most enduring environmental legacies, both in terms of potential benefits and potential costs.

Public policy affecting natural resource management during the Clinton years was heavily weighted toward environmental protection. The Administration proposed initiatives to reduce subsidies for private resource extraction on public lands, but Congress was not receptive. The Administration did, however, shift U.S. Forest Service priorities away from timber production to resource protection, placing some 60 million acres of Federal forests off-limits to road building. President Clinton also designated more than 20 new national monuments, thereby restricting the use of 6 million additional acres of Federal lands.

A critical issue addressed in this essay is how economics affected environmental and resource policy making during the decade of the 1990s. We focus on the Clinton Administration, and highlight important trends and changes in the impacts of economic thinking. This is a

particularly appropriate time to take a retrospective look at the 1990s and examine environmental policy during the Clinton years from an economic perspective.

Our analysis is primarily qualitative, although in cases in which quantitative economic analyses of environmental policies have been produced, we discuss those results. The analysis is not exhaustive, but we do our best to consider the most important and most prominent intersections of economics and environmental regulation over the decade.

In section 2, we provide a brief review of environmental quality changes during the 1990s. Then we focus our discussion around three themes: efficiency, cost-effectiveness, and distributional equity. In section 3, we highlight the ways in which the role of efficiency as a criterion for assessing environmental and natural resource rules and regulations was very controversial in the Clinton Administration, while economic efficiency emerged as a central goal of the regulatory reform movement in the Congress. In section 4, we examine how cost-effectiveness was embraced by both the Administration and the Congress in the 1990s as a criterion for adopting specific policy instruments. In section 5, we examine how and why the decade witnessed an increasing role for equity concerns as a consideration in environmental policy-making. In section 6, we conclude.

2.0 ENVIRONMENTAL QUALITY CHANGES DURING THE 1990S

Environmental quality improved overall during the 1990s. Trends in emissions of the criteria air pollutants are described in Table 1. Emissions of some of these pollutants decreased significantly during the decade.[2] For example, from 1990 to 1998, aggregate sulfur dioxide (SO_2) emissions decreased by 14 percent, volatile organic compounds (VOCs) by 15 percent, and carbon monoxide

[2]Real improvements in environmental quality would be measured by changes in exposure and resulting changes in human morbidity and mortality, ecosystem health, etc. Improvements in emissions, are not, themselves, measures of environmental quality improvements, although they may be highly correlated with such improvements.

(CO) by 9 percent (U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards 2000a, 2000b).[3]

Of course, downward trends in emissions (or exposure or risk, for that matter) are not necessarily attributable wholly or in part to regulations. In order to attribute environmental quality improvements to specific policies, we must compare actual emissions to what they would have been in the absence of policies. Based on such EPA modeling of trends in emissions with and without the Clean Air Act, the observed decreases in emissions of the criteria air pollutants between 1990 and 2000 can "reasonably be attributed to" the Clean Air Act and its amendments (Freeman 2001).

Emissions of most of the criteria pollutants declined much more dramatically over the twenty years prior to 1990, when the "low-hanging fruit" among air quality problems were being addressed. Lead emissions, which declined significantly, primarily due to the shift to unleaded gasoline (completed in 1987), saw no further improvement during the 1990s (U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards 2000a, 2000b). Emissions of particulate matter of 10 microns or more in size (PM_{10}) decreased by 46 percent from 1989 to 1990, but increased by 19 percent from 1990 to 1998.

The Toxics Release Inventory (TRI) data show a decrease in toxic discharges to air of 45 percent between 1990 and 1994 (Environmental Defense 2002).[4] These data have only been reported since 1988; unlike the criteria air pollutants, decreases in air toxics emissions during the 1990s were likely greater than decreases in previous decades.[5]

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[3]The exceptions are NO_x emissions, which continued to increase during the 1990s, but at a slower rate than in the previous two decades, and $PM_{2.5}$, for which national measurements were unavailable prior to 1990.

[4]In 1994, the Clinton EPA added 286 new chemicals to the list requiring TRI reporting. In 1999, it lowered reporting thresholds for many persistent bioaccumulative toxic chemicals and added more of these chemicals to the list. These two factors make it difficult to interpret trends in air toxics releases for the remainder of the decade, from 1994 to 2000.

[5]TRI-reported air emissions decreased by 17 percent between 1988 and 1990 (Environmental Defense 2002).

Following the pattern of 30-year trends, improvements in water quality during the 1990s were both less dramatic and more difficult to measure than improvements in air quality. One study of the period 1972 to the mid-1990s estimates that increases in the number of U.S. river miles meeting water quality standards for swimming, fishing, and boating attributable to Federal water quality legislation were 6.3 percent, 4.2 percent, and 2.8 percent, respectively, over the 18-year period (Bingham *et al.* 1998, Freeman 2001).[6] From 1975 to 1994, the share of measured water quality readings in violation of Federal standards for fecal coliform bacteria declined by 19 percent, for dissolved oxygen by more than 80 percent, and for total phosphorous by 20 percent (Freeman 2000).[7]

Nonpoint source pollution in the form of runoff from cities and agricultural areas may have increased during the 1990s (Freeman 2001). Improvements in water quality have been achieved largely through point source regulation (U.S. Environmental Protection Agency 1996). In contrast, releases of toxic chemicals to surface water, like releases of such chemicals to air, decreased during the 1990s. The Toxics Release Inventory (TRI) data show a decrease in toxic discharges to surface water of 67 percent between 1990 and 1994 (Environmental Defense 2002).[8]

As in the case of air quality regulation, much of the low-hanging fruit in water pollution control was harvested before the Clinton Administration took office. For example, between 1974

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[6]These relatively small changes in national compliance with water quality standards are indicators of a substantial difference between air and water quality in the United States. On average, water quality in the pre-regulation period (in this case, before the Federal Water Pollution Control Act of 1972) was fairly good. Improvements in water quality are more appropriately analyzed regionally or locally, since the small national changes mask the dramatic improvement of some local pollution problems, and the fact that many waters already supported their designated uses pre-regulation (Freeman 2001).

[7]It is not possible to determine from existing studies the extent of water quality improvements in the 1990s, nor the share of those improvements attributable to environmental regulation.

[8]The same caveat applied to TRI data on air toxics releases applies to water releases, as well, so we do not report decade-long changes. Unlike air toxics emissions, reported emissions of toxics to surface water did decrease dramatically during the first two years of TRI-required reporting – by 62 percent between 1988 and 1990.

and 1981, industrial and municipal biological oxygen demand loads in the U.S. decreased by 71 percent and 46 percent, respectively (Smith *et al.* 1987).[9]

Our ability to offer sound judgments about the influence of Clinton-era policies on environmental quality improvements is restricted by two problems. First, the fact that quality improvements occurred contemporaneously with the term of a particular administration or legislature is not proof that policies promulgated during this term actually caused those quality improvements. With the exception of criteria air pollutants in the 1990s, no studies have established such a causal relationship between 1990s policies and environmental quality changes.

Second, a fundamental issue that would confront any assessment of policy initiatives associated with a particular administration is the choice of an appropriate basis of comparison for evaluating policy initiatives – a counterfactual. It might appear reasonable to contrast first-term Clinton Administration initiatives with what might have been anticipated from a hypothetical second-term administration of George H. W. Bush. But what would be the appropriate counterfactual for the second Clinton term? For these reasons, establishing a causal relationship between improvements in environmental quality or resource management and the policies of any particular administration or Congress is difficult, if not impossible, and is not attempted here. Instead, we apply *economic* criteria for policy assessment – principally efficiency, cost-effectiveness, and distributional equity.

[9]These improvements, as well as many local improvements in dissolved oxygen might be attributed, in part, to increased wastewater treatment. Between 1970 and 1985, the fraction of U.S. residents served by wastewater treatment facilities increased from 42 to 74 percent (Boyd 2000).

3.0 EFFICIENCY AS A CRITERION FOR ASSESSING RULES AND REGULATIONS

The primary economic criterion for the analysis of environmental and natural resource regulation is efficiency. An efficient environmental or resource policy brings about a level of pollution control or a rate of resource extraction that maximizes the difference between social benefits and social costs.[10] Assessing the efficiency of policies requires benefit-cost analysis.

The Clinton Administration established an official framework for benefit-cost analysis of major regulations that was very similar to that established by previous administrations, but the influence of economic thinking in analyzing environmental rules and regulations within EPA declined significantly during the 1990s. While economists in other parts of the administration strongly pressed for efficiency in natural resource management, a negligible portion of their initiatives became policy. Congress during the 1990s was unsupportive of the Administration's proposals for efficiency in natural resource management, but Congress embraced efficiency as a criterion for environmental policy as part of its overarching regulatory reform agenda, and succeeded in making substantive, efficiency-related changes to a handful of existing environmental statutes.

3.1 Role and Acceptance of the Efficiency Criterion in the Clinton Administration

3.1.1 Executive Order on Regulatory Impact Analysis

The Clinton Administration, like its two immediate predecessors, issued an Executive Order (EO) requiring benefit-cost analysis of all Federal regulations with expected annual costs greater than $100 million.[11] Throughout the Reagan and Bush Administrations, these Regulatory Impact

[10]In a dynamic context, the efficient rate of resource extraction or pollution control maximizes the present value of net social benefits.

[11]The threshold is not indexed for inflation and has not been modified over time. Elsewhere in this paper, we refer to year 2000 dollars, unless we indicate otherwise.

Analyses (RIAs) were required under Reagan Executive Orders 12291 and 12498.[12] President George H. W. Bush created a Council on Competitiveness, chaired by Vice President Dan Quayle, which reviewed the impact on industry of selected regulations.

Shortly after taking office in 1993, Clinton abolished the Council on Competitiveness and revoked both of the Reagan orders, replacing them with EO 12866, *Regulatory Planning and Review*.[13] The Clinton EO was substantively and administratively similar to the Reagan orders. It was qualitatively different in tone, however, signaling a less strict efficiency test. While the Reagan orders required that benefits *outweigh* costs, the Clinton order required only that benefits *justify* costs. The Clinton EO allowed that: (1) not all regulatory benefits and costs can be monetized; and (2) non-monetary consequences should be influential in regulatory analysis (Viscusi 1996).

The requirements for Regulatory Impact Analysis, however, have not necessarily improved the efficiency of individual Federal environmental rules. In the first 15 years of the review process, under both Republican and Democratic administrations, about two-thirds of the Federal government's approved environmental quality regulations failed benefit-cost analyses, using the government's own numbers (Hahn 2000). A good example during the Clinton years is the 1997 NAAQS for ozone, for which EPA submitted an RIA that listed $2.0 to $11.2 billion in monetized

[12]Executive Order (EO) 12291 required agencies to conduct a regulatory impact analysis for all proposed and final rules that were anticipated to have an effect on the national economy in excess of $100 million. Executive Order 12498 required, in addition, a risk assessment for all proposed and final environmental health and safety regulations. EO 12291 has been called the "foremost development in administrative law of the 1980s" (Morgenstern 1997). The Reagan EOs were not the first presidential effort at regulatory efficiency, however. President Nixon required a "Quality of Life" review of selected regulations in 1971, and President Ford formalized this process in EO 11281 in 1974. President Carter's EO 12044 required analysis of proposed rules and centralized review by the Regulatory Analysis Review Group. The Administration of President George W. Bush has continued to enforce the RIA requirements of Clinton's EO 12866, rather than issuing a new EO (Graham 2001).

[13]In discussing Clinton's EO 12866, many analysts also mention EO 12875, Enhancing the Intergovernmental Partnership, which limited "unfunded mandates". While EO 12875 was part of the Administration's regulatory reform agenda, it did not refer to the efficiency or cost-effectiveness of environmental regulations.

benefits and $12.7 billion in costs through 2010, assuming full attainment (U.S. Office of Management and Budget 1998).[14]

Regulatory impact analysis is required only for major rules, a small fraction of all rules issued by EPA and other agencies. Rules that do not meet this threshold pass under the efficiency radar, as do Executive Orders such as those used by Clinton to designate 20 new national monuments comprising six million additional acres, restricting natural resource extraction and other commercial activities therein.

3.1.2 Diminished Role of Economic Analysis at EPA[15]

Given the increase in requirements for and attention to benefit-cost analysis by Congress during the 1990s, discussed below, EPA probably was required to do more passive applied economic analysis during the 1990s than at any other time in its 30-year history. Perhaps in response to this workload, the share of EPA employees with graduate degrees in economics grew during the 1990s.[16] However, the influence of economists and the acceptance of economic analysis at EPA were almost certainly lowered during the Clinton years (Morgenstern 1997).

The mixed record of political and administrative integration of economic analysis within EPA during the Clinton years reflects the ambivalence of the major environmental statutes with

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[14]In other cases, issuing agencies do not provide enough information to assess the benefits and costs of rules. During the Clinton Administration, a good example is the RIA for the U.S. Forest Service's Roadless Areas proposal, which discusses benefits and costs in general and qualitative terms but does not offer the information necessary to make a direct, quantitative comparison of costs and benefits (U.S. Forest Service 2001).

[15]We discuss at length the use and acceptance of economics at the Environmental Protection Agency (EPA), since rules promulgated by EPA comprise a substantial majority of total costs and benefits of all Federal environmental regulation. Fifty-four percent of total annual regulatory benefits and 50 percent of total annual regulatory costs identified by OMB in 1997 were attributed to environmental regulations (Dudley and Antonelli 1997, U.S. Office of Management and Budget 1997). Discussion of similar issues at the Departments of Energy, Agriculture, the Interior and other agencies is beyond the scope of this study.

[16]Between 1996 and 2000, the percent of EPA employees with graduate degrees who held either masters or doctoral degrees in economics increased by 15 percent, compared to a 7.7 percent overall increase in EPA employees with graduate degrees (Morgenstern 2000).

respect to the role of economic analysis.[17] EPA is not an economic agency. It has a mandate to protect human health and the environment through the administration of the major statutes. Many of those statutes constrain economic analysis, and the representation of economists within most EPA offices is relatively thin, particularly at the level of the Senior Executive Service.[18] However, there is a good deal of flexibility in the extent to which economic analysis influences EPA processes and decisions. As a result, the use and role of economic analysis at EPA has varied substantially from one administration to another.

Organizational Location of Core Economics Staff

During the Clinton Administration, economics staff at the agency were marginalized. When Clinton took office in 1992, the core economics staff at EPA were located within the Office of Policy, Planning and Evaluation (OPPE), as they had been since at least 1980. OPPE reviewed all draft regulations and provided the Administrator with an independent economic perspective, which could be quite different from program office analyses.[19] Within weeks of the Clinton inauguration, however, this role was eliminated, and economic analyses were rarely forwarded to Administrator Carol Browner during her eight-year tenure.

The substantive role of economic analysis in the development and review of EPA regulations was abandoned by the Agency in 1995, when the program offices, rather than the Administrator,

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[17]U.S. environmental laws alternately "forbid, inhibit, tolerate, allow, invite, or require the use of economic analysis in environmental decision making" (Morgenstern 1997). The term "major environmental statutes" in this paper refers to the following Federal laws (and all amendments thereto): the Clean Air Act (CAA), Federal Water Pollution Control Act (Clean Water Act, CWA), Toxic Substances Control Act (TSCA), Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and Safe Drinking Water Act (SDWA).

[18]See Morgenstern (1997). Of the 196 EPA Senior Executive Service members with graduate degrees in 1996, only four (2 percent) held graduate economics degrees; in contrast, almost one-third held law degrees, and one-fifth held graduate science degrees. Despite their minority status relative to lawyers, scientists and engineers, EPA employs more economists working on environmental issues than any other single institution.

[19]This practice was especially active under Administrator William Reilly, 1988-1992, who regularly sought the opinion of the economics staff.

became the official "clients" of these analyses (Morgenstern 2000). In 1999, OPPE was eliminated, shifting the core economics staff to a new Office of Policy and Reinvention. The shifts in organizational location of the core economics staff at EPA are documented in Table 2.

Perspective of Administrator Browner

Administrator Browner was openly dismissive of economics as an appropriate framework for environmental decisions. In her remarks in honor of the 30th anniversary of the first Earth Day, she commented on the establishment of the EPA, and recalled that "the nation committed itself to the task of eliminating pollution, to restoring our lands and waters to their uses, and to protecting public health without regard to cost. Let me repeat those last four words – *without regard to cost*" (Browner 2000). The Administrator went on to refer to the introduction of benefit-cost analysis into EPA regulations intended to protect public health as "poisoning the well".[20] The reduction in acceptance of economic analysis at EPA was likely influenced by Vice President Albert Gore, who was known to be deeply skeptical about the application of benefit-cost analysis to environmental policy (Gore 1992).

Role of the Environmental Economics Advisory Committee

Despite the reduced role of economists within the agency, policy advising by government economists outside of EPA was active during the 1990s. Deputy Administrator Fred Hansen worked closely with the Environmental Economics Advisory Committee (EEAC) within EPA's Science Advisory Board to develop an aggressive mission statement for the Committee that focused on giving expert advice on broad issues of importance to the Agency, rather than simply carrying out

[20]Although she referred to benefit-cost analysis, what Administrator Browner described was more like a strict benefit-cost test that would disallow rules unless quantified benefits outweighed costs. The influence of Administrator Browner's views on economic analysis was particularly important during the Clinton Administration, given her eight-year tenure in the position. The next-longest-serving EPA Administrators, William Reilly and Lee Thomas, each served four years.

end-of-pipe reviews of agency RIAs.[21] During the 1990s, the EEAC conducted the first comprehensive review and revision in 15 years of EPA's Economic Analysis Guidelines. They also thoroughly reviewed EPA's methodology for valuing reductions in cancer-induced mortality. External economists also served on the Advisory Council on Clean Air Act Compliance, required under the 1990 Clean Air Act (CAA) Amendments to provide technical and economic input on EPA's benefit-cost analyses of CAA impacts. The Council had a major impact on the identification of key research issues and the treatment of uncertainty in these analyses (Morgenstern 2000).

3.1.3 Role of Other Executive-Branch Economists in Natural Resource Policy

Having noted the diminished role of economics at EPA during the Clinton years, it is also important to recognize that economists external to EPA, in particular within the Council of Economic Advisors (CEA), Office of Management and Budget (OMB), and the Treasury Department, did have some influence over the Administration's policy proposals regarding efficiency in natural resource management.

The most important artifact of White House economic agencies' influence in emphasizing efficiency in environmental and natural resource policy is the Clinton Administration's 1993 economic stimulus and deficit reduction proposal. The Administration proposed a variety of policies related to natural resource subsidy reduction. First, it proposed increasing the baseline Federal grazing fee on public lands by almost 200 percent. The baseline Federal grazing fee had been calculated at only 56 to 83 percent of Federal costs per animal unit month in 1990 and was a much smaller percentage (perhaps 18 to 40 percent) of private market rates (Cody 1996). In theory, below-market fees for grazing livestock on public lands cause (economic) over-grazing. In practice,

[21]The Environmental Economics Advisory Committee was established by the Science Advisory Board in 1990.

low fees have been criticized from a budgetary perspective, since current fees do not cover the costs of Federal public range management.[22]

Similarly, below-cost timber sales from Federal lands theoretically lead to logging at faster-than-efficient rates, and where revenues do not cover costs, they also contribute to budget deficits. The Administration's 1993 budget proposal sought to phase out below-cost timber sales. By U.S. Forest Service (USFS) estimates, 77 of the 120 national forests showed net losses from timber sales over the period FY1989-FY1993, and 60 reported losses in every year over this period.

Neither subsidy reduction proposal – the grazing fee increase nor the below-cost timber sales phase-out – became law, however. The grazing fee proposal led to a Senate filibuster on FY 1994 Interior Appropriations during the 103rd Congress, and was taken up again in the 104th Congress, resulting in a negligible price increase, leaving rates still many times lower than the average private market rate. The plan to reduce below-cost timber sales was eliminated from Clinton's final budget proposal, and a USFS draft plan to phase out below-cost sales on one-half of forest service lands over four years was not adopted by the Administration.

The Administration's focus on natural resource subsidies in the 1993 budget proposal also included introduction of royalties for hardrock mining on public lands governed under the 1872 General Mining Law, increased fees for recreational use of Federal public lands, and a British Thermal Unit (BTU) tax, which would have taxed essentially all fuels. The BTU tax proposal faced stiff opposition in the first session of the 103rd Congress, but it narrowly passed the House of

[22]The baseline grazing fee for Federal lands in 1990 was $1.81 per animal unit month (AUM), while the various livestock grazing programs' cost to government of ranged from $2.18 to $3.24 per AUM. The fair market value of grazing on Federal land was last updated in 1986, and ranged from $4.68 to $10.26 per AUM for cattle and horses, varying by region (Cody 1996). (These figures have not been converted to constant dollars.) The Administration continued to lobby for fee increases, and the 104th Congress established a new fee formula that resulted in a small increase in the baseline fee, still many times lower than the average private market rate.

Representatives. Recognizing that the proposal did not have enough votes in the Senate, the Administration removed the BTU tax from its budget proposal.[23]

During the 1990s, economists at the U.S. Department of Commerce (DOC) began work on the issue of "green accounting." Incorporating natural resource depletion and other non-market activity within the National Income and Product Accounts (NIPA) has been a longstanding recommendation of economists (Pigou 1920, Weitzman 1976, Solow 1992, Nordhaus and Kokkelenberg 1999). Following hearings by the Joint Economic Committee, the 103rd Congress appropriated funds to the Bureau of Economic Analysis (BEA) at the DOC for this purpose. The BEA produced the first official U.S. Integrated Environmental and Economic Satellite Accounts in 1994, accounting only for selected subsoil minerals. Shortly afterward, Congress suspended BEA's work on environmental accounting, pending external review by a blue-ribbon panel convened by the National Research Council's Committee on National Statistics. Though the panel's review, released in 1999, strongly supported BEA's efforts and endorsed further efforts to extend the NIPA, Congress did not fund additional work on green accounting.

3.2 Role and Acceptance of the Efficiency Criterion in the Congress

While the Congress was unsupportive of efficiency as a criterion for natural resource management, benefit-cost analysis of environmental regulation emerged as a major goal of the Congressional regulatory reform efforts of the 1990s. We examine general and specific regulatory

[23]The Senate later passed a much more modest Transportation Fuels Tax in 1993, with revenues flowing to the General Fund. This was a retail tax on commercial gasoline sales of less than 5 cents per gallon. The BTU tax would have been imposed on coal, natural gas, liquid petroleum gases, nuclear electricity, hydroelectricity, and all imported electricity ($0.0257/million BTU); a higher tax ($0.0599/million BTU) would have been imposed on refined petroleum products. CEA economists and staff note that the experience with the BTU tax constrained their input to subsequent discussions regarding any kind of environmental taxation. The word "tax" was forbidden to appear within administration memos and other public documents, and taxes were never again seriously considered as potential environmental policy instruments during the Clinton years.

reform proposals considered by the 103rd through 106th Congresses, as well as changes to individual environmental statutes.[24]

3.2.1 Cross-cutting regulatory reform proposals

The 103rd Congress (1993-1995), the Clinton Administration's first legislative "partner," actively debated benefit-cost analysis and risk analysis as methods for informing environmental protection decisions (Blodgett 1995, Lee 1995). Three of the lightning rods for regulatory relief interests were "takings" issues or private property rights, unfunded mandates, and risk analysis. With Democratic majorities in both houses, none of the 103rd Congress' initiatives were enacted into law, or even offered for Presidential signature.

The regulatory reform movement gained momentum when members of the 104th Congress (1995-1997) took their seats after the 1994 midterm election, in which Republicans gained control of both the Senate and the House of Representatives. Reform-oriented bills in 1995-1996 included mandates for benefit-cost analysis, maximum likelihood risk assessments (rather than upper bounds), and regulatory process reforms (Viscusi 1996).

General Regulatory Reform: The Contract with America

Most of the 104th Congress' general regulatory reform proposals either failed to pass both Houses or were vetoed by President Clinton. The 1994 Contract with America's item 8, the "Job Creation and Wage Enhancement Act," did not reach the President's desk. It would have made Reagan's Executive Order 12291 statutory, superseding the Clinton Executive Order — as well as the language in several other important statutes — and would have required that the benefits of

[24] A comprehensive summary of successful and unsuccessful regulatory reform initiatives of the Congresses of the 1990s that would have influenced the application of efficiency, risk analysis, or cost-effectiveness criteria to environmental regulation is found in Table 2 of Cavanagh *et al.* (2001).

regulations outweigh their costs.[25] Although this component of the Contract with America did not become law, it did lead to a prominent public debate over regulatory reform, in which benefit-cost analysis was a central issue.

Specific Regulatory Reform Proposals

The Small Business Regulatory Enforcement Fairness Act (SBREFA, P.L. 104-121) amended the 1980 Regulatory Flexibility Act. As one of the affected agencies, EPA must prepare a regulatory flexibility analysis of all rules with "significant economic impact" on a "substantial number" of small entities (businesses, non-profits, and small government organizations).[26] Embedded within SBREFA, but for the most part unrelated to its other provisions, was the Congressional Review Act, which established a process of Congressional review and possible rejection of agency rules on efficiency grounds.

Under the Congressional Review Act, Agencies must submit all new rules to the House and Senate leadership, in addition to the General Accounting Office (GAO). Within 15 days, GAO must provide a report on each major rule to the agency's authorizing committee, after which any member of Congress may introduce a "resolution of disapproval," which is treated as a bill in the House and somewhat differently in the Senate. Congress then has 60 session days in which to act on the

[25]Item 8 also focused on the reduction of so-called "unfunded mandates," and on strengthening the Regulatory Flexibility Act of 1980, which resulted in the Small Business Regulatory Enforcement Fairness Act of 1996 and the Unfunded Mandates Reform Act of 1995. There were many other unsuccessful attempts at regulatory reform legislation during the 104th Congress, including H.R.1022, "Risk Assessment and Cost-Benefit Act of 1995"; H.J.Res. 27 and 54, which proposed a Constitutional amendment to ban unfunded mandates; H.R. 47, "Regulatory Relief and Reform Act"; and H.R. 122 to establish a Regulatory Sunset Commission. Detailed discussion of these is beyond the scope of this study. We mention them only to emphasize the scope and depth of the 104th Congress' focus on regulatory reform.

[26]These analyses, which must be reviewed by Congress, examine the type and number of small entities potentially subject to the rule, record-keeping and compliance requirements, and significant regulatory alternatives. The statute does not require formal benefit-cost analysis beyond that already required by environmental regulations and Executive Order; rather, it requires that EPA submit to Congress "a complete copy of the benefit-cost analysis of the rule, if any," along with the regulatory flexibility analysis. From an economic efficiency perspective, the focus on small entities makes little, if any sense, and the SBREFA requirements were viewed by EPA staff as little more than a time-consuming diversion from more important analyses and other activities.

measure; if the resolution of disapproval passes both houses, it must be signed by the President in order to reject the rule.[27]

In late 1996, in another attempt to emphasize efficiency in regulation, the 104th Congress attached a benefit-cost requirement to Section 645(a) of the Treasury, Postal Services and General Government Appropriations Act of 1997 (P.L. 104-208).[28] To meet this requirement, the Office of Management and Budget is required to submit to Congress a report estimating the "total annual costs and benefits of Federal regulatory programs, including quantitative and non-quantitative measures." The legislation also requires OMB to estimate individually the benefits and costs of rules with annual costs to the economy of $100 million or more. Importantly, OMB also is required to recommend the reform or elimination of any regulation that appears to be inefficient. Under this requirement, reports were submitted yearly, 1997 through 2000.[29] The requirement has further centralized regulatory oversight in the hands of OMB, which already had been charged with reviewing the RIAs required by Executive Orders since 1981.

Congressional regulatory reform efforts continued through the end of the Clinton Administration. The 105th and 106th Congresses considered establishing further checks on agency regulation. The Regulatory Improvement Act of 1999 (also known as the Thompson-Levin bill) would have allowed courts to remand or invalidate rules formulated by an agency that fails to

[27]The Congressional Review Act was the basis for the George W. Bush Administration's overturning of the Occupational Safety and Health Administration's ergonomics rule in March 2001. The CRA has not been used to overturn any environmental regulations.

[28]This provision was typically referred to as "regulatory accounting."

[29]The continuation of this provision was proposed by the Regulatory Right-to-Know Act of 1999 (S. 59). Introduced as H.R. 1074 in the House, the bill would have required much more stringent analysis by OMB: an annual accounting statement of total costs and benefits of Federal regulations, including direct and indirect impacts on Federal, state, local and tribal government, the private sector, small business, wages, and economic growth.

perform sufficient benefit-cost analysis.[30] While this bill never became law, the 106th Congress did pass a major piece of regulatory reform legislation, the Truth in Regulating Act (TIRA), which was signed into law (P.L. 106-312) by President Clinton in October 2000. The TIRA established a three-year pilot project beginning in early 2001, which required GAO to review RIAs to evaluate agencies' benefit estimates, cost estimates, and analysis of alternative approaches, upon request by Congress. Because funding was never provided, TIRA was not implemented. If TIRA had been implemented, it likely would have increased the importance of economic analysis in regulatory decision making.

3.2.2 Successful Changes to Individual Statutes

In addition to these attempts at cross-cutting regulatory reform, the Congresses of the Clinton years pursued efficiency within environmental statutes themselves.[31] In general, the Congress was more successful during the 1990s at passing cross-cutting regulatory reform bills than it was at reforming individual environmental statutes, although important exceptions were the 1996 Safe Drinking Water Act (SDWA) amendments and the partial reform of pesticide permitting under the Federal Food, Drug and Cosmetic Act (FFDCA).

Safe Drinking Water Act Amendments of 1996

The 1996 SDWA Amendments (P.L. 104-182) include the most far-reaching requirement for benefit-cost analysis in any environmental statute. The Amendments focus EPA regulatory efforts on contaminants that pose the greatest health risks by: (1) requiring benefit-cost analysis of

[30]The Regulatory Improvement Act was first proposed as S. 981 in 1997 and carried on with the same title into 1998. It was introduced in various versions in both Houses of Congress throughout 1997-1999, and took on the Thompson-Levin moniker in May 1999. A similar bill was introduced in the House in late 1999, but without the judicial review mandate.

[31]During the 1990s, the Congress also pursued reforms of non-environmental statutes that affect environmental regulation. For example, the Accountable Pipeline Safety and Partnership Act of 1996 (104th Congress) requires the Secretary of Transportation to issue pipeline safety regulations only upon justification that benefits exceed costs (Blodgett 1998).

new rules; (2) removing the mandate that EPA regulate 25 new contaminants every three years; (3) allowing EPA to use cost information to adjust its "feasibility standards" for water system reduction of contaminants; and (4) requiring the Administrator to balance risks among contaminants to minimize the overall risk of adverse health effects (Tiemann 1999). While the Amendments require EPA to determine whether the benefits of each new drinking water maximum contaminant level (MCL) regulation justify the costs, they also allow the Agency to adopt more stringent standards than those that maximize net benefits, explaining the reasons for not selecting the efficient standard.[32]

Food Quality Protection Act of 1996

The Food Quality Protection Act of 1996 (P.L. 104-170) amends both FIFRA and the FFDCA, removing pesticide residues on processed food from the group of Delaney "zero-risk standard" substances. The Delaney standard has long been a target of economic criticism on the grounds that it specifies an often unachievable regulatory standard for the benefits of regulation, and hence leads to associated costs that may greatly exceed benefits. While the standard continues to apply to non-pesticide food additives, the Food Quality Protection Act of 1996 eliminated the distinction between pesticide residues on raw foods (which had been regulated under FFDCA section 408) and processed foods (which had been regulated under FFDCA section 409 – the Delaney Clause).[33]

3.2.3 Failed Attempts at Changes to Individual Statutes

[32]See Safe Drinking Water Act §300g-1 (4)(C). The Amendments do not allow old standards to be subjected to an *ex-post* benefit-cost analysis.

[33]The Act also mandates that EPA coordinate pesticide regulation under FIFRA and FFDCA. For example, once a pesticide registration is canceled under FIFRA, the food-use tolerance under FFDCA must be revoked within 180 days, rather than the average six year time frame noted in a 1994 GAO report (Schierow 1996, U.S. General Accounting Office 1994).

Two of the environmental statutes most frequently criticized on efficiency grounds — Superfund (CERCLA) and the Clean Water Act (CWA) — remained relatively untouched by Congress in the 1990s, despite its focus on regulatory reform. Superfund's critics have focused on the low benefits and high costs of achieving the statute's standards (Viscusi 1992, Breyer 1993, Hamilton and Viscusi 1999). Reauthorization and reform were considered during the 105th Congress, but no legislation was passed. Rather than efficiency, liability issues and questions of how to finance Superfund were the major foci of legislative discussions. The taxes that support the Superfund trust fund (primarily excise taxes on petroleum and specified chemical feedstocks and a corporate environmental income tax) expired in 1995 and have not been reinstated.[34]

The 104th Congress also pursued efficiency-oriented reform of the Clean Water Act through the reauthorization process, but the effort failed in the Senate. During the 104th Congress, the House passed a comprehensive Clean Water Act reauthorization (H.R. 961) that would have been more flexible and less prescriptive than the current statute, but the Senate did not take up the bill.[35] No reauthorization legislation was considered in the 105th or 106th Congress.

3.3 Limited Effect of Regulatory Reform Legislation and Changes to Statutes

The cross-cutting legislative regulatory reform measures passed in the 1990s and the efficiency-related changes to specific environmental statutes had limited effects on regulation during the decade. This is in part due to differences between the Administration and the Congress in the acceptance of efficiency as an appropriate criterion for managing the environment and natural resources. An additional explanation is the existing statutory bias against benefit-cost analysis in

[34]The revenues now flowing into the trust fund come from so-called "potentially responsible parties", interest on the fund's investments, fines, and penalties. Then-Chairman of the House Ways and Means Committee, Bill Archer (R-TX), made it known that no reinstatement of the Superfund taxes would be considered without major reforms of the statute's liability provisions and other features. See Reisch (2000).

[35]The 103rd Congress had considered similar legislation (H.R. 3948, S. 2093), but no floor action on CWA reauthorization was taken in either house.

some cases, particularly under the Clean Air Act. In such cases, substantial movement toward efficiency in regulation cannot be expected without substantial changes in the authorizing legislation.

The SDWA Amendments of 1996 incorporated a strong benefit-cost criterion, in comparison to other environmental statutes. However, the decisions made on MCLs since the SDWA Amendments have not placed great weight on the results of required benefit-cost analyses. Two major rules proposed since the 1996 Amendments were those regulating allowable levels of arsenic and radon in drinking water.[36] EPA's benefit-cost analyses for the radon and arsenic MCLs can be interpreted as indicating that monetized costs exceed monetized benefits for both rules (by more than $50 million annually for radon, and $30 million annually for arsenic). The Agency maintained, however, that benefits of both rules justify their costs when unquantified benefits are included (Burnett and Hahn 2001).[37]

Importantly, the regulatory reform initiatives passed by Congress in the 1990s apparently did not influence EPA's issuance of NAAQS for ozone and particulate matter in July, 1997. Due to their high potential compliance costs, the revised standards were immediately controversial; both the decision to tighten the standards and the quality of the research used to support the new standards came under fire. EPA's cost estimates for the ozone standard were singled out for criticism; some analysts found them to be too low by a considerable margin (Shogren 1998, Lutter

[36]The arsenic rule was finalized on January 22, 2001, but implementation was delayed while the rule was taken under review by the George W. Bush Administration, citing concerns about the rule's costs and benefits. After an expedited review by the National Academy of Sciences, in October, 2001, EPA Administrator Whitman announced the Agency's intention to enforce the Clinton arsenic standard. No final action has been taken on radon.

[37]See U.S. Environmental Protection Agency (1999). EPA's cost and benefit figures for these rules were presented as annualized 1999 dollar values using a 7 percent discount rate. The AEI-Brookings Joint Center for Regulatory Analysis performed its own benefit-cost analysis of the arsenic rule, which concluded that in all likely scenarios the cost per life saved by the rule would never be less than $6.6 million, and that in its "most likely" scenario, cost per life saved was approximately $67 million. See Burnett and Hahn (2001). For a critical review of the EPA analysis and Burnett and Hahn, see Sunstein (2002). There will be more rulemakings under the SDWA over the next decade. In 1998, EPA published a list of 50 chemicals and ten microbiological contaminants that will be investigated for possible regulation.

1999). On the other hand, the particulate standard exhibited expected benefits that could well exceed costs by a considerable margin. Table 3 provides EPA's estimated benefits and costs for both standards.

The regulated community challenged the new NAAQS in court, and the case reached the U.S. Supreme Court in October, 2000.[38] Under the Clean Air Act, EPA is required to set health-based standards for specified pollutants without consideration of abatement costs. The Supreme Court ruled unanimously in February, 2001, that the CAA does not allow EPA to consider costs in setting NAAQS for the criteria air pollutants (and that the statute's mandate that the NAAQS protect the public health with "an adequate margin of safety" allows an acceptable scope of discretion to EPA).[39]

Given that the ozone standard's estimated costs appear to outweigh its benefits by a significant margin, EPA has been under considerable pressure to revise the standard, despite the Supreme Court's decision.[40] The situation is very different, of course, for particulate matter, for which estimated benefits appear to outweigh estimated costs. In any case, the NAAQS constitute a clear majority of the economic effects of all environmental policy changes during the 1990s. If the courts continue to uphold the standards and if the statutes preventing cost considerations remain unchanged, the stricter NAAQS for ozone and particulate matter may be one of the Clinton

[38]A group of forty economists filed a brief *amici curiae* in the Supreme Court, suggesting that benefit-cost analysis should be considered in the setting of ambient air quality standards (AEI-Brookings Joint Center *et al*. 2000).

[39]See U.S. Supreme Court (2001). The Supreme Court decision was greeted positively by EPA Administrator Christine Todd Whitman: "...Congress delegated to EPA the standard-setting function, and EPA carried it out appropriately" (U.S. Environmental Protection Agency 2001b). The Court acknowledged that EPA and the states could continue to take costs into account in implementing the standards, which may serve as an impetus for the adoption of cost-effective policy instruments.

[40]EPA has agreed to reconsider its analysis of ozone NAAQS benefits in at least one respect; the agency's initial analysis did not consider the possible damages associated with *decreases* in ground-level ozone, which leads to increases in some ultraviolet radiation (UV-B) exposure (Lutter and Wolz 1997).

Administration's most enduring environmental legacies, in terms of both potential benefits and potential costs.[41]

The differences in opinion between Congress and the executive branch (especially EPA) on the usefulness of efficiency analysis resulted in an effective stalemate. Even where statutes were explicitly altered to require benefit-cost analysis, as was the case for the setting of MCLs under the SDWA, rules promulgated during the 1990s were not any more or less efficient than rules promulgated during earlier decades.

4.0 COST-EFFECTIVENESS AS A CRITERION FOR ASSESSING PUBLIC POLICIES

Many or most environmental laws and regulations are not cost-effective, typically specifying technologies or uniform emissions limits, despite tremendous variation in abatement costs among sources (Newell and Stavins 2003, Tietenberg 1990). While uniform standards may effectively limit emissions of pollutants, they typically exact relatively high costs in the process, by forcing some firms to resort to unduly expensive means of controlling pollution. For example, under current regulations, the marginal cost of abating lead emissions ranges from $13 per ton in the non-metal products sector to $56,000 per ton in the food sector (Hartman *et al*. 1994, Morgenstern 2000).

Market-based approaches to environmental protection can be used to achieve the least-cost allocation of pollution reduction, even if the aggregate target is not efficient; thus, cost-effectiveness is a criterion quite separate and distinct from efficiency (Baumol and Oates 1971). A cost-effective regulatory policy takes environmental quality or natural resource extraction targets as given by the political process, but achieves those targets at minimum aggregate cost. Since the 1970s, the

[41]It remains to be seen whether some urban areas will be able to comply with the new ozone standards. One analyst estimates the costs to Los Angeles of meeting the ozone standard in 2010 will be about $15 billion in constant 2000 dollars, assuming a 5 percent decrease in current abatement costs due to technological change (Lutter 1999).

advantages of market-based (or economic-incentive) approaches in reducing the costs of environmental regulation have received serious political attention, and there have been increasing numbers of applications in the United States and other countries (Stavins 2002). Both the Clinton Administration and the Congress embraced cost-effectiveness as a criterion for adopting environmental and natural resource policies during the 1990s.

4.1 Support for the Cost-Effectiveness Criterion within the Clinton Administration

The Clinton Administration's support for the use of a cost-effectiveness criterion in choosing environmental policies was demonstrated in a variety of contexts. The administration included selection of cost-effective regulatory alternatives within Clinton EO 12866, requiring regulatory impact analysis. And in the same Earth Day speech that was so critical of benefit-cost analysis, EPA Administrator Browner highlighted EPA's cost-effective regulatory measures and flexible approaches to pollution reduction (Browner 2000). During the Clinton years, EPA continued to emphasize cost-effective approaches to pollution control, including the use of information disclosure and voluntary programs, and the Administration aggressively promoted international market-based policy instruments for greenhouse gas emissions control (specifically, emissions trading).

4.1.1 Reinventing EPA

Administrator Browner announced the creation of EPA's Office of Reinvention in 1997, although it is fair to say that reform efforts at EPA had been underway since the mid-1980s. Vice President Gore's National Performance Review Report and the Government Performance and Results Act of 1993 brought increased attention to such efforts at EPA, and the Agency launched the centerpiece of its "reinvention" program, the Common Sense Initiative (CSI) in 1994.[42]

[42]Other organizations and institutions may also have played a role in EPA's focus on reinvention. A 1995 National Academy of Public Administration report suggested reforms at EPA, including better use of risk and cost information to rank priorities. In 1996, the Center for Strategic and International Studies launched "Enterprise for the Environment," an effort to build consensus for systematic environmental management reform. And the regulatory reform focus of the 104th Congress may also have prompted EPA to attempt to carry out reform efforts, in part to forestall Congressionally

Although the CSI can be considered within the umbrella of policies intended to foster greater cost-effectiveness, it is unclear whether the CSI improved the cost-effectiveness of environmental regulation in the 1990s. The CSI engaged six major industries in dialogue with EPA with the purpose of reducing compliance costs, introducing flexibility by moving toward regulation by industry, rather than by pollutant, and reducing costly litigation through stakeholder participation.[43] But in 1997, two GAO reports found that too many CSI resources had been spent on process, and too few on substance and results. In addition, progress had been limited by the lack of consensus among industry workgroups on the most important issues, and the effort lacked results-oriented measures to assess progress (U.S. General Accounting Office 1997a, 1997b).

In 1995, Vice President Gore and Administrator Browner announced a set of 25 specific reinvention reforms at EPA, in addition to CSI. One of these new programs was Project XL ("Excellence and Leadership"), which set a goal of 50 pilot projects allowing regulated firms to propose alternatives to existing command-and-control regulations that would attain higher levels of pollution control at lower cost. The National Environmental Performance Partnership System sought to give states greater flexibility in achieving environmental goals by allowing them to convert some types of categorical Federal grants into more flexible block grants.

In its assessment of EPA's reinvention program, GAO noted that EPA's efforts could have only limited success in introducing cost-effective changes, because significant progress would require reform of the legislative framework for environmental protection, rather than process reforms within EPA.

4.1.2 Information Disclosure and Voluntary Programs

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mandated changes (Copeland 1996).

[43]The participating industries were auto manufacturing, computers and electronics, iron and steel, metal finishing, petroleum refining, and printing.

In addition to its reinvention efforts, EPA significantly increased use of information disclosure regulations during the 1990s. The Toxics Release Inventory (TRI) was initiated in 1988 under the Emergency Planning and Community Right-to-Know Act Section 313 and requires firms to report on use, storage and release of hazardous chemicals. A 1993 Clinton executive order required TRI reporting by Federal facilities. In 1994, EPA added 286 new chemicals to the list requiring TRI reporting, an 80 percent increase in the number of listed chemicals. Further, EPA lowered reporting thresholds in 1999 for many persistent bioaccumulative toxic chemicals and added more of these chemicals to the TRI list.[44] The Clinton Administration announced another expansion of TRI on January 17, 2001, considerably lowering the threshold for reporting lead emissions.[45]

Releases reported under TRI declined by 45 percent from 1988 to 1998, but no analysis has yet been able to attribute that reduction to the policy itself. Limited evidence exists that publicly available information about firms' TRI emissions (either in absolute terms or relative to some benchmarks) negatively affects stock prices (Hamilton 1995, Konar and Cohen 1997, Khanna *et al.* 1998). Other possible avenues through which the TRI may influence emissions are green consumerism, redirection of firms' attention toward measures that increase environmental performance while saving costs, and community pressure, but there is little solid evidence that any of these forces are at work (Snyder 2001).

In addition to the Toxics Release Inventory, EPA established new and expanded existing information programs during the 1990s. In 1997, EPA expanded the existing Energy Star Buildings program, consolidating it with the Green Lights program. In 1998, the Agency began requiring

[44]The EPA under Clinton also continued the 33/50 program, started under the Bush Administration, which engaged TRI-reporting industries in achieving voluntary accelerated emissions reduction targets in exchange for public "certification."

[45]The previous standard required reporting by facilities that manufacture or process more than 25,000 pounds of lead annually, or that use more than 10,000 pounds annually. The newer standard required reporting by any facility that manufactures, processes, or uses more than 100 pounds annually. The Bush Administration announced its intention to uphold the new threshold on April 17, 2001.

public water systems to issue annual Drinking Water Consumer Confidence Reports. In 2000, it posted automobile "pollution rankings" on the EPA web site, ranking vehicles based on hydrocarbon and NO_x tailpipe emissions. While these programs could, in theory, provide cost-effective ways of reaching environmental objectives, there is no solid evidence of their actual effects.

4.1.3 Cost-Effectiveness and Climate Change Policy

In October 1993, the Administration released its Climate Change Action Plan, which recommended 52 voluntary measures to meet greenhouse-gas emissions goals. The nature of the initiatives in the plan are not unlike those that might have been expected from a second-term Bush Administration, with their emphasis on voluntary programs, government-industry cooperation, cost-effectiveness, use of market incentives, and minimal mandatory government intervention.[46] But, even if not different in substance, the Clinton Administration's Climate Action Plan differed greatly in tone from what had been Bush Administration policy. Not surprisingly, this complex set of voluntary initiatives had relatively little effect. By 1995, the U.S. acknowledged that it would fall short of its goals by at least 50 percent.

A key component of the Clinton Administration's climate change policy was its strong and unwavering support for cost-effective approaches, including market-based instruments, in particular, tradeable permit mechanisms.[47] The Administration's formal proposal released in preparation for the Third Conference of the Parties of the Framework Convention on Climate Change (FCCC), held in Kyoto, Japan, in November, 1997, called for domestic and international emissions trading. In fact, it was largely because of the efforts of the U.S. negotiating team that the Kyoto Protocol

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[46]In 1993, the Administration also established the U.S. Initiative on Joint Implementation under the Climate Change Action Plan. Joint implementation arrangements allow firms or other entities in one country to meet part of their greenhouse gas reduction commitments by financing mitigation in another country. The U.S. Initiative through 2000 had approved 26 arrangements whereby U.S. firms agreed to finance projects in 11 other countries.

[47]The prior Bush Administration had taken a similar though less aggressive position. See, for example, Stewart and Wiener (1992).

included significant provisions for international emissions trading among the industrialized nations, as well as what came to be known as the Clean Development Mechanism for offsets in developing countries.

Subsequently the United States proposed rules for international emissions trading in 1998, at preparatory talks for the Fourth Conference of the Parties. The U.S. proposal faced substantial opposition, most significantly from the European Union. No agreement was reached on emissions trading at the Fourth (1998), Fifth (1999), or Sixth (2000) Conferences of the Parties. Indeed, at the Sixth Conference of the Parties, which met in The Hague in November, 2000, disagreements between the United States and the European Union on the role of carbon sequestration and emissions trading led to the ultimate breakdown of the talks.

Economic considerations appear to have played a much more substantial role in the development of the Administration's international negotiating position on climate change than they did in the development of domestic regulatory policies with substantial economic costs, such as the NAAQS for ozone and particulate matter. Within the White House, weekly (and even more frequent) meetings on climate change leading up to the Kyoto conference were chaired by the National Economic Council (NEC), the coordinating body for economic policy during the Clinton years.[48] In contrast, EPA was relatively disengaged on this issue.

CEA testimony on this occasion and many other occasions emphasized the enormous cost savings that could be achieved through emissions trading and through participation by developing countries, possibly contributing to the passage of Senate Resolution 98.[49] In addition, the CEA

[48]The major role of the economic agencies in developing U.S. climate change policy began at least as early as July 1997, when then-Chair of the Council of Economic Advisers (CEA), Janet Yellen, testified before the House Commerce Committee, Subcommittee on Energy and Power.

[49]The so-called "Byrd-Hagel resolution" stated that the United States should not approve any agreement at the Third Conference of the Parties in Kyoto, Japan, that did not impose binding emission reduction targets on major developing countries as well as industrialized nations.

resisted pressure to adopt in its own 1998 report on the costs of complying with the Kyoto Protocol's targets overly optimistic assumptions about technological change and energy efficiency advanced by the so-called "DOE Five Lab study" (Interlaboratory Working Group 1997) and by the Interagency Analytical Team study on the economic effects of global climate change policies (Interagency Analytical Team 1997).

4.2. Support for the Cost-Effectiveness Criterion from Congress

In 1995, the 104th Congress enacted the Unfunded Mandates Reform Act (P.L. 1044). The main purpose of the Act was to require quantitative assessment of benefits, and comparison of benefits with costs for proposed and final rules, including environmental regulations, with an expected cost to state, local, and tribal governments, or to the private sector, greater than or equal to $100 million. The Act also mandates that agencies choose the least-cost regulatory alternative, or explain why they have not done so.

4.3. Mixed Results on Cost-Effectiveness of Specific Policies

Integration of the cost-effectiveness criterion into environmental policy-making made more progress than the efficiency criterion in the 1990s. We consider implementation of the 1990 Clean Air Act Amendments during the decade as a case study.

4.3.1 Implementation of the 1990 Clean Air Act Amendments

While the judiciary in the 1990s upheld CAA provisions preventing EPA from taking costs into account when setting the NAAQS, the 1990 Amendments provided the basis for implementation of cost-effective regulation. Under Title IV of the amendments, Congress directed EPA not to mandate specific pollution control technologies for sulfur dioxide (SO_2) emissions from power plants, but set up instead a permit trading system. Not all regulations promulgated under the 1990 CAA Amendments were equally as cost-effective, however. The Amendments explicitly required

EPA to issue technology standards for 188 toxic air pollutants, perhaps one of the most expensive and least cost-effective components of the statute (Portney 1990).

Market-Based Instruments in CAA Amendment Implementation

EPA provided averaging, banking, and trading opportunities for most of the new standards promulgated under the 1990 CAA Amendments, including those aimed at mobile sources. EPA's implementation of the reformulated gasoline provisions of Title II of the Amendments allowed refinery-level trading of oxygen, aromatics, and benzene content.[50] Title II also authorized EPA to regulate particulate matter, nitrogen oxide (NO_x), and other emissions from heavy-duty trucks. The resulting regulations were promulgated at the vehicle engine-manufacturing level, and allow averaging, banking, and trading.[51] The Tier 2 emissions standards for cars and light-duty trucks, issued in February 2000, allow vehicle manufacturers to average NO_x emissions throughout their fleets to meet the new national tailpipe standards. They also allow refiners and gasoline importers to average, bank, and trade gasoline sulfur content to meet new Tier 2 standards.[52]

With respect to stationary sources, the regional NO_x cap-and-trade program in the Northeast is another significant market-based policy instrument developed and implemented under the 1990 Clean Air Act Amendments. Although the SO_2 allowance trading program was created under the Bush Administration, implementation of Phase I and Phase II occurred during the 1990s. These two programs are described below, as are two significant rulemakings that have been more heavily

[50]The initial guidance for the reformulated gasoline trading programs was issued in October 1992, during the Bush Administration. Trading at the refinery level has been very active (U.S. Environmental Protection Agency 2001a).

[51]While a great deal of averaging and banking has taken place, only one trade was completed through 2000 (U.S. Environmental Protection Agency 2001a).

[52]The average sulfur content cap drops annually between 2004 and 2006, and credits produced within that time frame have a limited life, while credits produced after the introduction of the strictest standard (2006) have unlimited life.

criticized from an economic perspective: the revised ambient air quality standards for ozone and particulate matter, and new regulations on toxic air pollutants.

Sulfur Dioxide Allowance Trading

The tradeable permit system that regulates SO_2 emissions, the primary precursor of acid rain, was established under Title IV of the Clean Air Act Amendments of 1990. The statute is intended to reduce SO_2 and NO_x emissions from 1980 levels by 10 million tons and 2 million tons, respectively.[53] The first phase of SO_2 emissions reductions was started in 1995, with a second phase of reduction initiated in the year 2000.[54]

A robust market of bilateral SO_2 permit trading emerged in the 1990s, resulting in cost savings on the order of $1 billion annually, compared with the costs under some command-and-control regulatory alternatives (Carlson *et al.* 2000). Although the program had low levels of trading in its early years (Burtraw 1996), trading levels increased significantly over time (Schmalensee *et al*. 1998; Stavins 1998; Burtraw and Mansur 1999).

Regional NO_x Budget Program

Under EPA guidance, twelve northeastern states and the District of Columbia implemented a regional NO_x cap-and-trade system in 1999 to reduce compliance costs associated with the Ozone Transport Commission (OTC) regulations of the 1990 CAA Amendments.[55] Required reductions are based on targets established by the OTC and include emissions reductions by large stationary sources. The program is known as the Northeast Ozone Transport Region (Farrell *et al*. 1999).

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[53]For a description of the legislation, see Ferrall (1991).

[54]In Phase I, individual emissions limits were assigned to the 263 most SO_2-emissions-intensive generating units at 110 plants operated by 61 companies, located largely at coal-fired power plants east of the Mississippi River. Under Phase II of the program, beginning January 1, 2000, almost all electric power generating units were brought within the system.

[55]Seven OTC states have also implemented state-level NO_x trading programs: New Jersey, Connecticut, Delaware, New York, Massachusetts, New Hampshire and Maine (Solomon 1999).

EPA distributes NO_x allowances to each state, and states then allocate allowances to sources in their jurisdictions. Each source receives allowances equal to its restricted percentage of 1990 emissions, and sources must turn in one allowance for each ton of NO_x emitted over the ozone season. Sources may buy, sell, and bank allowances. Potential compliance cost savings of 40 to 47 percent have been estimated for the period 1999-2003, compared with a base case of continued command-and-control regulation without trading or banking (Farrell *et al*. 1999).

Maximum Available Control Technology for Air Toxics

The air toxics regulations necessitated by the 1990 CAA Amendments could be among the least cost-effective components of the Clean Air Act, depending on how they are implemented. The Amendments mandated that EPA issue standards for 188 toxic air pollutants, substances that are less common than the criteria pollutants for which NAAQS are promulgated, but may pose threats to human health. Like the NAAQS, the statute's treatment of toxic air pollutants requires EPA to set standards so that resulting concentrations provide an "ample margin of safety" against deleterious human health effects. Unlike in the case of the NAAQS, however, the Administrator of EPA is directed to require the maximum degree of emissions reduction achievable, taking costs into consideration.

Although EPA is allowed to take costs into account when determining standards for hazardous air pollutants, the type of regulation required by the CAA Amendments is a technology standard — Maximum Achievable Control Technology (MACT) — not a market-based approach. From 1992 through August 2000, EPA issued technology standards for 45 of these substances, covering 82 categories of industrial sources. While there are no estimates of the total monetized costs and benefits of this new set of technology standards for hazardous air pollutants, one analyst in 1990 estimated that when fully implemented, compliance costs would range from $7.9 to $13.2

billion per year, and benefits would range from $0 to $5.3 billion per year (Portney 1990).[56] The lower bound of zero on potential benefits is indicative of the considerable uncertainty over risks posed by these pollutants to human health. Some analysts have been particularly critical of EPA's very conservative estimates of risks to human health from air toxics in its promulgation of standards (Stroup 2000, Gray and Graham 1991).

The mix of market-based and command-and-control regulations within the 1990 CAA Amendments demonstrates that while cost-effectiveness was increasingly accepted by the Administration, the Congress, and other participants in public discourse during the 1990s, application to actual policies was inconsistent. In reality, market-based policy instruments are used to implement only a very small fraction of environmental regulation in the United States.

4.3.2 Cost-Effectiveness of Selected EPA Regulations

Most of the "stock" of regulations currently on the books were created without regard to choosing least-cost compliance alternatives, and the cost-effectiveness criterion influences only a small portion of the "flow" of regulations. To keep this fact firmly in mind, we provide the cost per statistical life saved of selected EPA rules from the 1980s and the 1990s in Table 4.

5.0 INCREASING ROLE OF DISTRIBUTIONAL EQUITY IN ENVIRONMENTAL POLICY

The increase in attention to efficiency and cost-effectiveness in environmental regulation is correlated with the substantial increase in the cost of such regulations to the U.S. economy from the 1970s through the 1990s (Portney 1998, Jaffe et al. 1995). There has also been an increase in the benefits of environmental regulation over the same period. The third theme in our analysis suggests

[56]These figures were Portney's "educated guess" in 1990, based on George H. W. Bush Administration estimates and those of a 1990 consulting firm study. We have converted them to 2000 dollars, assuming that they were originally stated in 1990 dollars. See Portney (1990).

that as both costs and benefits of environmental and natural resource regulation have increased, attention to the *distribution* of these costs and benefits has increased as well.

5.1 Environmental Justice and the Distribution of Environmental Benefits

In addition to requiring RIAs, Clinton's EO 12866 instructed agencies to select regulatory approaches that would maximize net benefits, *including distributive impacts and equity*, unless a statute required otherwise. This was the first time that distributional concerns had been included within the series of Presidential Executive Orders dealing with regulatory analysis.

Increased attention to equity concerns during the 1990s was frequently characterized under the rubric of "environmental justice." In 1994, Executive Order 12898 instructed Federal agencies to identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

In practice, agencies have responded to the two executive orders by including a separate distributional impact analysis within RIAs. Subsequent to EO 12898, environmental justice was mentioned in RIAs for rules in which agencies were required to address the issue, but only infrequently was quantitative analysis included.[57] In no case did the Administration's explicit concern for equity clearly alter proposed policies.

5.2 Property Rights Movement and the Distribution of Regulatory Costs

Increased attention to the distribution of the costs of environmental and natural resource regulation in the 1990s was exemplified by the rise of the "property rights" movement, concerned with costs to private landowners, especially in Western states, of laws such as the Endangered Species Act and wetlands regulations under Section 404 of the Clean Water Act. In addition,

[57]In some cases, RIAs mention that distributional impact analysis was conducted, but the analysis is not presented.

concern about the distribution of costs may partly underlie continued inefficient subsidization of natural resource extraction during the 1990s.

5.2.1 Endangered Species Act

The distributional implications of the Endangered Species Act (ESA) were the focus of much debate during the 1990s. Private landowners objected to restrictions they claimed amounted to *de facto* seizures of private property ("takings") under the Fifth Amendment to the U.S. Constitution. Such interpretation of regulatory restrictions on private land use under the ESA as "takings" has generally not been upheld by the courts, but from an economic perspective, the concern of private property owners that they bear the costs of public goods provision is a distributional issue.

Attempts to reauthorize the Endangered Species Act in the 1990s failed, but the Clinton Administration made substantive administrative changes, aimed at rationalizing the incentives for private landowners under the Act.[58] The changes had broad bipartisan support in Congress.

5.2.2 Wetlands Regulation

The debate over land-use restrictions governed by wetlands regulation under Section 404 of the Clean Water Act in the 1990s was similar in nature to the ESA "takings" debate. Congress did not pass any major changes to Federal wetlands regulation, although a series of actions by the Clinton Administration during the decade exemplify conflicts over distributional concerns within the regulatory framework. In 1998, the Army Corps greatly reduced the scope of nationwide permit

[58]The Administration implemented four provisions that had been included within many of the unsuccessful Congressional reauthorization attempts and had broad bipartisan support. First, the Administration emphasized habitat conservation plans (HCPs) as a tool to manage endangered and threatened species on non-Federal lands. Under Section 10 of the ESA, private landowners applying for an "incidental take" permit must submit a HCP, in which they agree to restrict some uses in the interest of species and habitat protection in exchange for the permit. More than 250 habitat conservation plans were completed between 1992 and 2000, compared to 14 between 1982 and 1992. HCPs are considerably more flexible than direct enforcement of the Act. Second, voluntary "safe harbor" agreements guarantee that increases in species populations on private lands will not restrict future land use decisions. Third, the controversial "no surprises" rule guarantees that a landowner properly carrying out a habitat conservation plan will not experience further restrictions or costs without mutual consent. Fourth, "candidate conservation agreements" allow landowners to protect declining species that are not yet listed, in exchange for assurance that no additional measures will be required if species are listed.

26, which authorizes discharges into non-tidal headwaters and isolated waters, a change that resulted in lawsuits by the development and commercial communities.[59] In addition, the Clinton Administration endorsed the concept of wetlands mitigation banking in 1993. Mitigation banking would likely reduce the costs of wetlands regulation to private land owners and developers, but it has been opposed by environmental advocacy groups on the grounds that it does not adequately protect these ecologically valuable areas.

5.2.3. Natural Resource Extraction Subsidies

Within its first budget proposal to Congress, the Clinton Administration proposed reducing a variety of natural resource extraction subsidies, including those for logging, mining, and grazing livestock on public lands. These efforts were opposed vigorously by advocates of the "property rights" movement. The Congress opposed all of the natural resource initiatives in the Clinton proposal, with one exception – the 104th Congress established a framework for user fee demonstration projects within the National Park Service (P.L. 104-134).[60]

5.3. Efficiency and Equity as Issues of Political Convenience

The Clinton Administration's focus on environmental justice in the 1990s could, of course, be seen as the desire of a Democratic administration to reach out to minority and low-income communities. The Administration's many attempts to introduce greater efficiency in natural resource management through subsidy reduction could be seen as an attempt to support efficiency

[59]The so-called "nationwide permits" authorize landowners to proceed with specified categories of activities without obtaining individual permits, reducing regulatory burdens. The waters governed by permit 26 are often difficult to identify as wetlands because they may appear dry for much of the year and do not exhibit the vegetation characteristic of wetlands, but scientific evidence is mounting of their important function within aquatic ecosystems (Copeland 1999).

[60]Congress also opposed, in one important case, the application of the cost-effectiveness criterion to natural resource management. The Sustainable Fisheries Act of 1996 (P.L. 104-297) amended the Magnuson-Stevens Fishery Conservation and Management Act, imposing a four-year moratorium on new individual tradeable quota programs among the nation's eight regional fishery management councils and repealing one such program that had been created in 1995 (Buck 1996). The Act did not, however, repeal the five other existing ITQ programs.

where efficient policies were in close alignment with the preferences of the environmental community, a strong base of Democratic support.[61]

Similarly, Congress' opposition to natural resource subsidy reduction, when compared with its strong support for efficiency in environmental pollution control regulation, could be seen as the desire of a Republican legislature to forward the interests of supporters in the regulated community, typically conservative voters. Congressional support for extensive subsidies to grazing, timber extraction, mining and other activities expanded the message of regulatory reform, from the traditional industry association community to working-class, resource-based communities, particularly in the Western United States. The Congress in the 1990s appears to have supported efficiency where efficient policies were in close alignment with the preferences of its conservative base.

The notion of using benefit-cost analysis as a guide to regulation for environmental protection and natural resource management does not appeal to most interest groups or policy partisans, except where it is seen as a tool to achieve pre-determined goals. Politicians may thus endorse the use of the efficiency criterion only where its results are likely to be compatible with their own ideological agendas. The inconsistent application of efficiency analysis to environmental and natural resource regulation in the 1990s is part of a wider pattern of focus on the distribution of the costs and benefits of environmental and natural resource regulation in the United States.

5.4. Distribution Becomes More Salient as the Economic Impacts of Policies Increase

[61]The views of economists with respect to natural resource extraction and pricing are closely aligned with the views of strict conservationists, while economists' views with respect to environmental pollution control often contradict the views of strict conservationists. That is, current rates of natural resource extraction in many countries are likely greater than the efficient rates, due to the presence of substantial subsidies and unregulated negative externalities. Thus, economists' call for efficiency in resource management often supports higher prices and slower extraction. In contrast, economists' call for efficiency in environmental regulation may often support a decrease in existing pollution control standards, as most industrialized countries have experienced a period of increasing stringency of environmental pollution control regulation over the past 30 years, and some of this regulation may have costs that exceed associated benefits.

The tremendous increase in the aggregate costs and benefits of environmental and natural resource regulation over the past 30 years has focused substantial attention on the efficiency and cost-effectiveness of regulation. In addition, the presence of large costs and benefits from regulation has focused the attention of lawmakers and other participants in the policy process on the distribution of these costs and benefits.

Where pollution damages are highly localized, regulations that set aggregate standards for pollution emissions or concentrations can have differential distributional impacts that may be unappealing on equity grounds.[62] Policies that restrict natural resource management alternatives have inherently differential distributional impacts in the United States, where economic dependence upon resource extraction is highly localized. Even where it may be efficient to proscribe specific commercial activities or other resource uses from a national perspective, some local communities will experience substantial net losses from such policies.

An example may be the U.S. Forest Service's (USFS) Roadless Areas Initiative. The USFS regulatory impact analysis for the rule did not quantify benefits and costs. Hence, no definitive efficiency conclusions can be drawn. But inventoried roadless areas comprise about two percent of the U.S. landmass, and 31 percent of the U.S. Forest Service's property. These areas are characterized by rugged terrain and low-value timber, and they may be ecologically sensitive. These characteristics may suggest relatively low costs to leaving them in their current state, and relatively

[62]Uneven distributional impacts can have implications for the efficiency of a regulation, as well, if damages are nonlinear. If marginal damages increase at an increasing rate, total damages (hence total benefits of regulation) may increase when damages are concentrated in certain areas.

high environmental benefits of preservation.[63] Nonetheless, any reduction in commercial timber harvest associated with the Rule negatively affects some communities.[64]

Given that natural resource management regulations will necessarily have uneven distributional impacts, Congressional opposition to increasing efficiency and cost-effectiveness in natural resource management during the 1990s is not surprising. When the "winners" from a natural resource management policy are "American citizens as a whole" and the "losers" are identifiable members of particular Congressional districts, members of Congress are reluctant to impose those losses on their own district or a colleague's district. Similarly, as the substantial gains from 30 years of environmental pollution control regulation have been seen to accrue disproportionately to some communities over others, the debate has shifted, somewhat, from efficiency to distributional equity.

The implications of the increased focus on distribution in environmental and natural resource policy are twofold from the perspective of economics. First, while economists can analyze the distribution of costs and benefits from a regulation, they have little to contribute to the debate over how costs and benefits *should* be distributed. Second, in some cases, attempts to meet distributional goals (whether they succeed or not) may interfere with attempts to satisfy criteria of efficiency and cost-effectiveness.

6.0 CONCLUSIONS

[63]Clinton Forest Service Chief Mike Dombeck pointed out that these areas were the 58.5 million acres of Forest Reserves created between 1891 and 2000, many of which had remained roadless through 20 presidencies. In addition, by USFS calculations, less than two-tenths of one percent of the U.S. timber harvest and less than four-tenths of one percent of U.S. oil and natural gas reserves will be affected by the Roadless Rule (Dombeck 2001). Any benefit-cost calculation would also have to account for the costs of maintaining forest system roads. In 2000, USFS maintained a road system of more than 386,000 miles, with a maintenance backlog in excess of $8 billion.

[64]The state of Idaho, the Kootenai Indian tribe and logging groups challenged the Roadless Rule in Federal court. In May 2001, a U.S. District Court judge in Idaho issued a preliminary injunction blocking the rule. The Bush administration declined to appeal the ruling. In December 2002, the 9th U. S. Circuit Court of Appeals overturned the District Court ruling, reinstating the Roadless Rule.

Three conclusions emerge from our review of the role of economic analysis in environmental and natural resource policy during the 1990s. First, the use of efficiency as a criterion for assessing environmental and natural resource rules and regulations was controversial in the Clinton Administration, while economic efficiency emerged as a central goal of the regulatory reform movement in the Congress. Second, cost-effectiveness as a criterion for adopting specific policy instruments was embraced by both the Administration and the Congress in the 1990s. Most interest groups in the environmental community and the regulated community could support cost-effectiveness, because it reduced the burden of compliance on industry and made stringent environmental targets more affordable. But benefit-cost analysis raised the issue of goals or standards, as well as costs, and the process of setting goals was (and is) inherently more controversial than minimizing the costs of achieving them.

Third, during the 1990s, equity concerns played increasing roles in environmental and natural resource policy debates. Both the efficiency and the cost-effectiveness criteria may be hard to swallow when the distributional impacts of regulation are highly skewed. Examples continue to surface regularly in debates over the fairness of policies such as individual transferable quota systems for fisheries management, differential exposure to environmental hazards, and impacts on western farming communities of reduced availability of irrigation water to protect endangered species. The focus on equity in environmental policy debates is likely to intensify as the costs and benefits of regulation continue to rise.

Table 1. U.S. Emissions of Seven Major Pollutants, 1970-1998

Year	SO_2	NO_x	VOCs	CO	Lead	PM_{10}	$PM_{2.5}$
1970	100	100	100	100	100	N/A	N/A
1980	83	117	85	91	34	N/A	N/A
1989	75	114	73	82	3	100	N/A
1990	76	115	68	76	2	54	100
1991	74	116	68	78	2	53	97
1992	73	118	67	75	2	53	96
1993	72	119	67	76	2	50	92
1994	70	121	70	79	2	56	100
1995	62	119	67	72	2	48	90
1996	61	118	60	74	2	61	103
1997	63	119	61	73	2	63	107
1998	63	117	58	69	2	64	105

Sources: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (2000a, 2000b).

Notes: Figures are indexed from EPA data, with 1970 aggregate U.S. emissions equal to 100 for all pollutants except PM_{10} (1989=100) and $PM_{2.5}$ (1990=100). Data for 1970 and 1980 drawn from U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (2000a); data for 1989, 1991-1995 and 1997 drawn from U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards (2000b). Data for 1990, 1996 and 1998 appear in both reports. (Data for PM_{10} differ between the two reports — for this pollutant, the 2000b data were used exclusively.) Data for particulate matter include only directly emitted PM. No figures are shown for PM_{10} and $PM_{2.5}$ in 1970 or 1980; while estimates exist, they do not include natural sources, agriculture, forestry, fugitive dust and other sources which together comprise almost 90 percent of directly emitted PM_{10} and almost 70 percent of directly emitted $PM_{2.5}$ in 1990.

Table 2. Shifts in Organizational Location of Economic Analysis at EPA

Years	Organizational Location of Core Economics Staff at EPA
1980-1983	Benefits Staff, Office of Policy Evaluation, Office of Policy and Resource Management
1983-1987	Benefits Branch, Office of Policy Analysis, Office of Policy, Planning and Evaluation
1987-1990	Economic Analysis Branch, Office of Policy Analysis, Office of Policy, Planning and Evaluation
1990-1996	Economic Analysis and Research Branch, Office of Policy Analysis, Office of Policy, Planning and Evaluation
1996-1999	Economy and Environment Division, Office of Economy and Environment, Office of Policy, Planning and Evaluation
1999-2000	Economic and Policy Analysis Division and Economy and Environment Division, Office of Economy and Environment, Office of Policy and Reinvention
2000-2001	National Center for Environmental Economics, Office of Policy, Economics and Innovation

Source: U.S. Environmental Protection Agency, National Center for Environmental Economics World Wide Web site, available at http://www.epa.gov/economics/.

Table 3. Benefits and Costs, Revised NAAQS for Ozone and Particulate Matter

National Ambient Air Quality Standard, 1997	Annual Monetized Benefits	Annual Monetized Costs
Ozone	$2.0 to $11.2 billion	$12.7 billion
Particulate Matter	$26.4 to $145 billion	$48.8 billion

Source: U.S. Office of Management and Budget (1998), reporting EPA estimates from Regulatory Impact Analysis. EPA estimates were in constant 1990 dollars; those reported here are 2000 dollars. Cost and benefit estimates assume full attainment.

Table 4. Cost of Selected EPA Regulations per Statistical Life Saved

Environmental Protection Agency Regulation	Year	Cost per Statistical Life Saved (millions of 2000$)
Benzene fugitive emissions	1984	5
Radionuclides at uranium mines	1984	11
Asbestos prohibitions: manufacture, importation, processing and distribution in commerce (total)	1989	21
National primary and secondary water regulations – Phase II: MCLs for 38 contaminants	1991	28
Hazardous waste management system – wood preservatives	1990	57
Sewage sludge use and disposal regulations, 40 CFR Part 503	1993	215
Land disposal restrictions for third third scheduled waste	1990	215
Hazardous waste management system: final solvents and dioxins land disposal restrictions rule	1986	226
Prohibition on land disposal of first third of scheduled wastes ("second sixth" proposal)	1988	452
Land disposal restrictions, Phase II: universal treatment standards and treatment standards for organic toxicity, characteristic wastes, and newly listed wastes	1994	1,030
Drinking water regulations, synthetic organic chemicals, phase V	1992	10,800
Solid waste disposal facility criteria, 40 CFR Parts 257 and 258	1991	40,700

Source: Adapted from Hahn *et al.* (2000). "Cost per statistical life saved" refers to net costs (costs minus cost savings, but not taking into account benefits in terms of reduced mortality risk) of discounted lives saved. The estimates for the first two rules in the table (both 1984) are from Viscusi (1996), and are not necessarily comparable.

Notes: All values are millions of 2000 dollars annually; these final rules are ranked in order of decreasing cost-effectiveness. Net cost-effectiveness values are costs, less cost savings.

Table 5. Acronyms

AEI	American Enterprise Institute for Public Policy Research
AUM	Animal Unit Month
BEA	Bureau of Economic Analysis, U.S. Department of Commerce
BTU	British Thermal Unit
CAA	Clean Air Act of 1970
CEA	Council of Economic Advisors
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CO	Carbon Monoxide
CSI	Common Sense Initiative, U.S. Environmental Protection Agency
CWA	Clean Water Act (Federal Water Pollution Control Act of 1972 and Amendments)
EEAC	Environmental Economics Advisory Committee, EPA Science Advisory Board
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FCCC	Framework Convention on Climate Change, United Nations
FFDCA	Federal Food, Drug and Cosmetics Act of 1938
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act of 1972
GAO	General Accounting Office
MACT	Maximum Available Control Technology
MCL	Maximum Contaminant Level
NAAQS	National Ambient Air Quality Standard
NIPA	National Income and Product Accounts
NO_X	Nitrogen Oxides
OMB	Office of Management and Budget
OPPE	Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency
OTC	Ozone Transport Commission
PM	Particulate Matter
RCRA	Resource Conservation and Recovery Act of 1976
RIA	Regulatory Impact Analysis
SBREFA	Small Business Regulatory Enforcement and Fairness Act
SDWA	Safe Drinking Water Act of 1974
SO_2	Sulfur Dioxide
TIRA	Truth-in-Regulating Act of 2000
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act of 1976
USFS	U.S. Forest Service
VOC	Volatile Organic Compound

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