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Note

**Tailoring Cost-Benefit Analysis to Environmental Policy Goals:
Technology- and Health-Based Environmental Standards In the Age of
Cost-Benefit Analysis**

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Tailoring Cost-Benefit Analysis to Environmental Policy Goals: Technology- and Health-Based Environmental Standards In the Age of Cost-Benefit Analysis[†]

March Sadowitz¹

I. INTRODUCTION

Ideally, environmental regulations would control pollution by establishing protective standards that industries could comply with, using inexpensive, technologically feasible technology. After twenty years of experimentation, however, environmental scientists still find it difficult, if not impossible, to determine appropriate safety levels for most pollutants.² Current scientific findings lead to the conclusion that certain pollutants are toxic in any amount, so that to be effective, safety standards must establish zero-discharge levels.³ In other situations, no feasible technology exists by which to control pollution emissions. Congress, frustrated by this regulatory inaction, has mandated that regulators revise their methods of establishing pollution discharge standards by abandoning safety as the basis for the standards and focusing instead on the availability of feasible technology.⁴ [1]

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² See Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613, 1619 (1995).

³ Guidelines for Carcinogen Risk Assessment, 51 Fed. Reg. 33992 (1986).

⁴ For example, the Clean Water Act requires the use of best available technology. 33 U.S.C. § 1314(b)(1)(B) (1994).

This Note examines the impact of cost-benefit analysis on health-based and technology-based environmental standards, using the Clean Air Act (“CAA”)⁵ and the Clean Water Act (“CWA”)⁶ as examples. Part II of this Note defines health-based and technology-based standards and discusses their economic and scientific weaknesses. Part III describes cost-benefit analysis and how it affects environmental regulations. Parts IV and V analyze the impact of imposing cost considerations on standards established under the Clean Air Act and the Clean Water Act. Finally, this Note concludes in Part VI that a cost-benefit framework would defeat the purpose of aspirational standards, but would be useful for health-based maximum-risk standards and implementable technology-based standards. [2]

II. BACKGROUND

Today, federal law governs almost every aspect of environmental protection,⁷ from cleaning up abandoned waste sites⁸ to preserving endangered species.⁹ Experts, however, say that not all environmental laws have met with equal

⁵ Congress enacted the Clean Air Act to regulate air emission discharges. Pub. L. No. 91-604, 84 Stat. 1676 (1970) (codified at 42 U.S.C. § 7401) (1988).

⁶ The Federal Water Pollution Control Act (“Clean Water Act”), enacted in 1972, controls water pollution discharges. Pub. L. No. 92-500, 86 Stat. 816 (1972) (codified as amended at 33 U.S.C. § 1251 (1994)).

⁷ Some areas of environmental policy, such as land use zoning, have historically been regulated by state and local governments rather than by the federal government. See Michael F. Reilly, *Transformations at Work: The Effect of Environmental Law on Land Use Control*, 24 REAL PROP. PROB. & TRUST 33 (1983).

⁸ The Comprehensive Environmental Response Compensation and Liability Act (“CERCLA”) authorizes the President to take remedial action at hazardous waste sites and extract financial sanctions from responsible parties. 42 U.S.C. §§ 9604, 9607, 9622 (1988 & Supp. V. 1993).

⁹ The Endangered Species Act seeks to preserve endangered species to the extent practicable. 16 U.S.C. § 1531 (1988).

success,¹⁰ and the present quest for smaller government has re-ignited the ten-year old debate over regulatory reform.¹¹ [3]

Heightened public awareness of the costs associated with environmental protection has led to proposals that would require more balanced regulatory decisions, instead of harsh rules that disregard costs.¹² The present cost of environmental protection in the United States is at least \$140 billion a year.¹³ The growth of articles in the popular press¹⁴ and the recent flurry of activity in Congress suggest a desire to give greater weight to cost considerations in environmental decisions.¹⁵ [4]

¹⁰ Clean Air Act and Clean Water Act regulation of discharges into the environment from point sources has been successful compared to the largely non-existent regulation of non-point sources. William K. Stevens, *Earth Day At 25: How Has Nature Fared?*, N.Y. TIMES, Apr. 18, 1995, at C1, C5.

¹¹ The regulatory reform movement wants "smaller government"---that is, it wants the federal government to shrink in size and influence---and wants regulatory decision-making to be more economically rational. See, e.g., Robert W. Hahn, *Regulatory Reform: The Whole Story*, WALL ST. J., Feb. 27, 1995 at A1 (describing current Congressional proposals); see generally STEPHEN BREYER, REGULATION AND ITS REFORM (1982) (arguing that science and economics could be used to improve the efficiency of health, safety and environmental regulation).

¹² See HARVARD GROUP ON RISK MANAGEMENT REFORM, REFORM OF RISK REGULATION: ACHIEVING MORE PROTECTION AT LESS COST 30 (March 1995) (urging legislation requiring a "reasonable relationship" between regulatory costs and benefits); see also STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE 67 (1993) (proposing insulated federal executive-branch risk analysts to ensure more rationality in regulatory decision-making).

¹³ Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency, EPA-230-11-90, ENVIRONMENTAL INVESTMENTS: COST OF A CLEAN ENVIRONMENT (1990) (estimating 1993 environmental expenditures as 2.4% of GNP).

¹⁴ See, e.g., Orrin G. Hatch & John Kyl, *Stop the Regulation Machine*, N.Y. TIMES, July 18, 1995, at A13 (urging passage of a regulatory reform proposal); Frank Clifford, *Does The Earth Still Need Protection?*, L.A. TIMES, Apr. 22, 1995, at A1 (presenting a twenty-year environmental report card); Spenser Abraham, *How To Get The Courts Out of the Business of Regulation*, WASH. TIMES, Mar. 22, 1995 at A23 (criticizing EPA's increasing use of consent decrees); John H. Cushman Jr., *Congressional Republicans Take Aim At An Extensive List of Environmental Statutes*, N.Y. TIMES, Feb. 22, 1995, at A14 (documenting numerous Republican proposals to alter the federal regulatory apparatus).

¹⁵ The first session of the 104th Congress introduced legislation to incorporate cost-benefit analysis into a diverse range of environmental regulatory decisions. See, e.g., S. 854, 104th Cong., 1st Sess. § 1238c(b) (1995) (requiring the Secretary of Agriculture to maximize net environmental benefits per dollar of technological assistance); S. 1316, 104th Cong., 1st Sess. § 2(7) (1995) (proclaiming cost benefit analysis important in prioritizing risks addressed by the Safe Drinking Water Act); H.R. 961, 104th Cong., 1st Sess. § 234 (1995) (directing the EPA Administrator not to promulgate rules under the Clean Water Act costing more than \$25 million unless the rule maximizes net benefits to society); H.R. 1371, 104th Cong., 1st Sess. § 1 (1995) (proposing a cost-benefit framework for relocating sewage outfall to deep-water locations). For a discussion of Congressional risk-benefit proposals from previous sessions, see Dalton G. Paxman, *Congressional Risk Proposals*, 6 RISK: HEALTH, SAFETY & ENV'T 183 (Spring 1995).

Congress is currently considering the reauthorization or overhaul of most major environmental laws.¹⁶ The 104th Congress passed legislation that requires the Environmental Protection Agency (“EPA”) to conduct a cost-benefit analysis for each major rule it enacts.¹⁷ The EPA must also certify that it considered performance-based¹⁸ and no-action¹⁹ regulatory alternatives.²⁰ Proposed amendments to the Clean Water Act explicitly require the EPA Administrator to certify that any new regulation “maximizes net benefits to society.”²¹ Even if these amendments are not passed, it is clear that existing law²² and presidential executive orders²³ will impose more stringent cost-benefit requirements on environmental regulations. [5]

Crafting wiser controls in the future requires analysis of previous environmental regulatory tools. The analysis should include both the successes and the failures of meeting pollution reduction goals, and the costs involved. The Clean Air Act²⁴ and Clean Water Act²⁵ both serve as good examples for assessment,

¹⁶ See, e.g., S. 1316, 1st Sess., 104th Cong. (1995) (proposing amendments to the Safe Drinking Water Act), S. 503, 104th Cong., 1st Sess. (1995) (proposing amendments to the Endangered Species Act), H.R. 2500, 104th Cong., 1st Sess. (1995) (proposing amendments to the Comprehensive Environmental Response, Compensation and Liability Act), H.R. 291, 104th Cong., 1st Sess. (1995) (proposing amendments to the Resource Conservation and Recovery Act), and H.R. 1152, 104th Cong., 1st Sess. (1995) (proposing amendments to the Clean Water Act).

¹⁷ Risk Assessment and Cost-Benefit Analysis Act of 1995, H.R. 1022, 104th Cong., 1st Sess. § 202(a)(2) (1995) (passed by the House of Representatives).

¹⁸ Performance-based alternatives identify regulatory goals but do not specify what means to employ to achieve them.

¹⁹ No-action alternatives are, just as they sound, the regulatory alternative of doing nothing.

²⁰ H.R. 1022, *supra* note 16, § 202(a)(1)(A).

²¹ H.R. 961, 104th Cong., 1st Sess. § 324(a)(1) (1995).

²² Congress recently enacted the Unfunded Mandates Reform Act, which requires that the EPA justify through cost-benefit analysis regulations that cost state, local, and tribal governments, or the private sector, more than \$100 million annually. Pub. L. No. 104-4, 109 Stat. 48 (to be codified in 2 U.S.C. § 1501).

²³ Executive Order No. 12,866 requires cost-benefit analysis through centralized administrative review within the executive branch. 3 C.F.R. 638 (1994); Unfunded Mandates Reform Act of 1995, *supra* note 21.

²⁴ 42 U.S.C. §§ 7401-7671q (1994).

²⁵ 33 U.S.C. §§ 1251-1387 (1994).

because they both contain ambient²⁶ and individual-facility standards,²⁷ health-based and technology-based standards, and a range of methods for considering costs. Both are over twenty years old, have been amended several times,²⁸ and are recognized for significantly improving the quality of the environment.²⁹ [6]

A. *Defining Health-Based and Technology-Based Standards*

Health-based and technology-based standards constitute the two main approaches to environmental regulation: regulations typically either specify the amount of contaminant a discharge may contain, based on the contaminant's effects on health, or they specify the type of technology to be used to reduce or eliminate the polluting discharge.³⁰ Technology-based standards are standards that mandate the use of a particular technology to control environmental discharges.³¹ This Note classifies any regulation that specifies the amount of a contaminant allowed in a discharge as a health-based standard.³² [7]

²⁶ Ambient standards set allowable limits of contaminants in background air and water. See James E. Krier, *On the Topology of Uniform Environmental Standards in a Federal System - And Why it Matters*, 54 MD. L. REV. 1226, 1227 (1995).

²⁷ Effluent or facility standards establish limits for different types of discharges within an industrial category. Lynn M. Gallagher, *The Clean Water Act*, in ENVIRONMENTAL LAW HANDBOOK 147 (Thomas F.P. Sullivan ed., 1995).

²⁸ See *infra* notes 129-37 and 173-81 and accompanying text.

²⁹ Air pollution emissions and water pollution discharges have declined since the passage of the Acts. Robert W. Hahn, *United States Environmental Policy: Past, Present and Future*, 34 NAT. RES. J. 305, 311-13 (1994).

³⁰ WALTER A. ROSENBAUM, ENVIRONMENTAL POLITICS AND POLICY 115-16 (Congressional Quarterly Inc., 1985).

³¹ The Clean Air Act regulates hazardous air pollutants by requiring the use of maximum achievable control technology ("MACT"); the MACT floor is set at the average emissions level of twelve percent of the best performing facilities in an industry. 40 C.F.R. § 63.51 (1995).

³² In practice, the EPA may base such standards on effects to human health, environmental health, or some arbitrary value. For instance, the Safe Drinking Water Act establishes maximum contaminant levels for the protection of human health, 42 U.S.C. § 300g-1 (1988 & Supp. V 1993), and the Clean Water Act makes it an interim national goal to achieve water quality for the "protection and propagation of fish, shellfish and wildlife." 33 U.S.C. § 1251(a)(2) (1994). For some pollutants, however, no safe level can be assumed, and limitations are set where the level of risk presented is considered acceptable. Courts have interpreted this to mean that the most exposed individual is protected against risks greater than one-in-one-million without regard to cost or feasibility, and as many citizens as economically and technologically feasible are protected against risks of one-in-one hundred-thousand or greater. *NRDC v. EPA*, 863 F.2d 1224 (9th Cir. 1988).

Most major federal environmental statutes seek to prevent harm to human, rather than ecological, health when setting standards.³³ The science of human health risk assessment has evolved more rapidly than the science of ecological risk assessment, because the dynamics of ecosystems are highly complex and poorly understood.³⁴ Health-based statutes either specify narratively the measure of protection that Congress has mandated,³⁵ or they quantify that level.³⁶ This type of regulatory framework allows Congress to enact legislation that refers to the protection of its constituents' health, while leaving the agency with the thorny task of determining safety. [8]

In contrast, technology-based standards either mandate the type of technology to be used to reduce discharges, or they establish the level of discharge to be achieved regardless of the means.³⁷ These standards consider engineering, rather than economic, feasibility, and they can be divided into two categories: best demonstrated available technology ("BDAT")³⁸ and best available technology ("BAT").³⁹ Regardless of whether the standard is based on BDAT or BAT, that standard will not

³³ For instance, the Clean Air Act seeks to "promote public health." 42 U.S.C. § 7401 (b)(1) (1988). The Clean Water Act designates toxic pollutants as those that cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, or physical deformations. 33 U.S.C. § 1362(13) (1994). The Safe Drinking Water Act requires establishment of maximum-contaminant-level goals for contaminants that "may have any adverse effect on the health of persons." 42 U.S.C. § 300g-1.

³⁴ Howard Latin, *Ideal Versus Real Regulatory Efficiency: Implementation of Uniform Standards and 'Fine-Tuning' of Regulatory Reforms*, 37 STAN. L. REV. 1267, 1273 (1986).

³⁵ The Clean Air Act regulates hazardous air pollutants so as to provide "an ample margin of safety." 42 U.S.C. § 7412 (b)(1)(B) (1988 & Supp. V 1993).

³⁶ If technology-based hazardous air pollutant standards leave a residual individual lifetime cancer risk of one in one million, the agency will promulgate more stringent health-based standards. 42 U.S.C. § 7412 (f)(2).

³⁷ WILLIAM H. RODGERS, JR., *ENVIRONMENTAL LAW* 54 (2d. ed. 1994)(describing technology-based standards as subjecting dischargers to standards based on what the best technology could achieve).

³⁸ The Resource Conservation and Recovery Act gave the EPA the flexibility to adopt health-based standards, but the Agency, exasperated with its unsuccessful attempts to set health-based standards for pollutants, instead chose to require the best demonstrated available technology. 42 U.S.C. § 6924(m) (1988). The EPA may use the BDAT so long as it catalogues the uncertainties inherent in the use of health-based levels. *Hazardous Waste Treatment Council v. EPA*, 886 F.2d 355, 363 (D.C. Cir. 1989).

³⁹ Congress, frustrated by agency inaction in other situations, has included language in statutes requiring the agency to promulgate standards and determine an appropriate technology. For example, the Clean Water Act requires the use of best available technology to reduce discharge of toxic water pollutants. 33 U.S.C. § 1317(a).

necessarily regulate to an “ample margin of safety,” as some health-based standards do, because technology-based standards are not designed to do so. [9]

B. *Scientific Credibility*

It may appear from the definitions of health-based and technology-based standards that only health-based standards require information about the health effects of pollution on the environment. Technology-based standards, however, also rely on the science of environmental health effects.⁴⁰ Evaluation of the success or failure of a given standard requires regulators to quantify the health benefits that result from the use of the given technology.⁴¹ To quantify these health effects, regulators first use risk assessment to determine the effects of pollution. The National Academy of Science defines risk assessment as “the qualitative or quantitative characterization of the potential health effects of particular substances on individuals or populations.”⁴² Risk assessment examines both the cancerous and the non-cancerous effects of pollutants.⁴³ The risk assessment paradigm requires the assessor to identify the hazard, assess the exposure, evaluate the dose-response relationship, and characterize the risk.⁴⁴ [10]

The ideal estimate of a safe pollution level draws on the experience of past human exposure to a particular pollutant at the same dose and duration.⁴⁵ Unfortunately, epidemiological data⁴⁶ exists for relatively few pollutants.

⁴⁰ See JUDITH BENTKOVER ET AL., BENEFITS ASSESSMENT: THE STATE OF THE ART 6-7 (1986).

⁴¹ *Id.*

⁴² COMMITTEE ON THE INSTITUTIONAL MEANS FOR ASSESSMENT OF RISKS TO PUBLIC HEALTH, RISK ASSESSMENT IN THE FEDERAL GOVERNMENT: MANAGING THE PROCESS, NATIONAL RESEARCH COUNCIL 38 (1983). This assessment is different from risk management---another facet of environmental regulation---which is the “process of evaluating . . . regulatory [choices] and selecting among them.” *Id.* at 18.

⁴³ Non-cancerous effects include neurological, immunological, reproductive, and developmental effects, as well as kidney, liver, or skin disease. JANE HOPPIN, HARVARD CENTER FOR RISK ANALYSIS, RISK ASSESSMENT IN THE FEDERAL GOVERNMENT: QUESTIONS AND ANSWERS 9 (1993).

⁴⁴ *Id.* at 7.

⁴⁵ FRANK B. CROSS, ENVIRONMENTALLY INDUCED CANCER AND THE LAW: RISK REGULATION AND VICTIM COMPENSATION 45-46 (1989).

⁴⁶ Epidemiology is the study of the spread of diseases caused by pollution through populations and communities. R. J. LINCOLN ET AL., A DICTIONARY OF ECOLOGY, EVOLUTION AND SYSTEMATICS 81 (1982).

Regulators extrapolate safe estimates from animal studies,⁴⁷ and while industry uses thousands of chemicals, animal studies have been conducted for only several hundred.⁴⁸ [11]

Current cancer risk assessment models assume a linear relationship between dose and response; thus even extremely low doses yield some probability of cancer.⁴⁹ The EPA uses the most sensitive animal test data to determine toxicity.⁵⁰ Scientists conduct animal studies using a high dose for a short time and extrapolate the results to determine the effects of low doses in humans over long periods of exposure.⁵¹ Cancer risk assessment produces a dose-response curve that enables calculation of a probability of cancer at any given exposure level.⁵² [12]

Attempts to develop methods for quantifying non-cancerous human health risks have not proved as successful as those used to quantify cancer risks.⁵³ The estimation of non-cancerous effects relies on a model that assumes that exposure below the threshold level does not cause any effects.⁵⁴ The threshold is assumed to exist at a level between the highest dose that did not cause an effect and the lowest dose that caused an effect.⁵⁵ The reference dose is calculated by dividing the highest level that did not cause an effect by a series of “uncertainty factors;”⁵⁶ any amount greater than the reference dose is considered unsafe. The probability of a non-cancerous effect at any given dose level, however, cannot be computed.⁵⁷ [13]

47 Alon Rosenthal et al., *Legislating Acceptable Cancer Risk from Exposure to Toxic Chemicals*, 19 *ECOLOGY L.Q.* 269, 280 (1992).

48 Mark Eliot Shere, *The Myth of Meaningful Environmental Risk Assessment*, 19 *HARV. ENVTL. L. REV.* 409, 434 (1995).

49 Guidelines for Carcinogen Risk Assessment, *supra* note 2, at 33998.

50 *Id.* at 33997.

51 Rosenthal et al., *supra* note 46, at 282.

52 *Id.* at 285.

53 Ellen K. Silbergeld, *The Risks of Comparing Risks*, 3 *N.Y.U. ENVTL. L.J.* 405, 412-13 (1994).

54 HOPPIN, *supra* note 42, at 31.

55 *Id.*

56 Uncertainty factors attempt to account for differences between species and the possibility of extra-sensitive humans. See Michael L. Dourson & Jerry F. Stara, *Regulatory History and Experimental Support of Uncertainty (Safety) Factors*, 3 *REG. TOX. & PHARM.* 224, 225 (1983).

57 This is so because non-cancer risk assessment assumes that there is a threshold. Theoretically, a dose above the threshold should yield a 100% probability of the non-cancerous effect. Since experiments are unable to demonstrate the actual threshold, analysts instead must use conservative approximations. Katherine Walker et al., *Confronting Superfund Mythology: The Case of Risk*

In the face of uncertainty,⁵⁸ the EPA has chosen conservative risk-assessment models, in order to err on the side of safety.⁵⁹ In addition to uncertainty about dose-response and extrapolation, risk assessors must face variations among humans.⁶⁰ Some scientists argue that these uncertainties make scientific knowledge an inadequate basis for setting regulatory priorities.⁶¹ [14]

Critics of risk assessment exist at both poles and argue that risk assessment is either too conservative⁶² or not conservative enough.⁶³ Some criticize the science as a mere buttress for prefabricated regulatory decisions.⁶⁴ Others criticize risk assessment for its inability to separate assessment from management, arguing that risk assessors make policy decisions when choosing to use conservative models and exposure data sets instead of more realistic ones.⁶⁵ [15]

Administrative decision-makers do not necessarily tailor their decisions in light of the uncertainties identified in risk assessments.⁶⁶ Some argue that the courts require the use of risk assessment where statutes drafted by Congress provide only modest support for its use in regulatory decision-making.⁶⁷ Although risk

Assessment and Management, in SUPERFUND, ECONOMICS, SCIENCE AND LAW 51, n.4 (Richard L. Revesz & Richard B. Stewart, eds. 1995).

⁵⁸ For a discussion of current uncertainties and possible standardization of uncertainty techniques, see Arlene Yang, *Standards and Uncertainty in Risk Assessment*, 3 N.Y.U. ENVTL. L.J. 523 (1994).

⁵⁹ Ellen K. Silbergeld, *Risk Assessment: The Perspective and Experience of U.S. Environmentalists*, 101 ENVTL. HEALTH PERSPECTIVES 100, 101 (June 1993).

⁶⁰ For instance, the National Research Council found that current pesticide regulation was not protective of children who weigh less and eat more fruits and vegetables than adults. NATIONAL RESEARCH COUNCIL, PESTICIDES IN THE DIETS OF INFANTS AND CHILDREN 360 (1993).

⁶¹ See Lois Gold et al., *Rodent Carcinogens: Setting Priorities*, 258 SCIENCE 261 (1992).

⁶² INSTITUTE FOR REGULATORY POLICY, A BLUE PRINT FOR CONSTRUCTING A CREDIBLE ENVIRONMENTAL RISK ASSESSMENT POLICY IN THE 104TH CONGRESS 5 (1995).

⁶³ Adam M. Finkel, *Is Risk Assessment Really Too Conservative?: Revising the Revisionists*, 14 COLUM. J. ENVTL. L. 427, 441-47 (1989).

⁶⁴ Barry Commoner, *The Hazards of Risk Assessment*, 14 COLUM. J. ENVTL. L. 365, 366 (1989).

⁶⁵ COMMITTEE ON THE INSTITUTIONAL MEANS FOR ASSESSMENT OF RISK TO THE PUBLIC, *supra* note 41, at 3.

⁶⁶ Howard Latin, *Good Science, Bad Regulation, and Toxic Risk Assessment*, 5 YALE J. ON REG. 89, 145 (1988).

⁶⁷ Shere, *supra* note 47, at 420.

managers must combine risk assessment with other factors when making policy decisions,⁶⁸ “we are largely past the question of whether to assess toxic risks, and must now determine how to improve the quality of risk assessment.”⁶⁹ [16]

C. *Economic Inefficiencies*

The implementation of both health-based and technology-based standards has suffered from economic inefficiencies. Health-based standards become economically inefficient when regulators choose a maximum individual risk⁷⁰ as a ceiling, above which they consider no risk as acceptable, regardless of the costs.⁷¹ In these situations, even if a cost-benefit analysis shows that a regulatory alternative is inefficient, regulators may nevertheless implement that alternative. Many environmental decisions only consider the risks to individuals;⁷² in order to calculate the benefits of pollution control under a cost-benefit analysis, however, the regulator must examine the overall population risk, because spreading pollution control resources efficiently requires knowing which risks affect the greatest number of people.⁷³ [17]

Ironically, critics attack technology-based standards as being even more economically inefficient than health-based standards. Although the majority of environmental gains have resulted from standards based on engineering feasibility (rather than individual or population risk control),⁷⁴ economic inefficiencies plague

⁶⁸ March Sadowitz & John D. Graham, *A Survey of Residual Cancer Risks Permitted by Health, Safety and Environmental Policy*, 6 RISK: HEALTH, SAFETY & ENV'T 17, 34 (1995) (recommending case-by-case risk management consideration to include number of persons exposed to a risk, the demographic and ethnic traits of exposed citizens, public concern, controllability, affordability and cost-effectiveness).

⁶⁹ Latin, *supra* note 65, at 147.

⁷⁰ The person at the maximum individual risk has the largest probability of cancer from an environmental risk. Rosenthal et al., *supra* note 46, at 290.

⁷¹ Cross, *supra* note 44, at 77.

⁷² For example, after implementation of technology-based standards, the EPA will be required to enact more stringent standards if the individual risk of cancer around the facility exceeds one in one million. 42 U.S.C. § 7412(f)(2).

⁷³ Since individual risk is the probability that one exposed person will get cancer, population risk is that probability multiplied by the number of people exposed. This yields the number of cancers in the population, or the population risk. James T. Hamilton & W. Kip Viscusi, *Human Health Risk Assessments for Superfund*, 21 ECOLOGY L. Q. 573, 591 (1994).

⁷⁴ Rodgers, *supra* note 36, at 55.

this regulatory approach.⁷⁵ For example, while the application of BAT⁷⁶ can successfully limit point-source discharges,⁷⁷ it only works if industries actually comply with BAT requirements; BAT does not address or control unpermitted point-source discharges. [18]

To set technology-based standards,⁷⁸ the EPA must gather engineering and cost information across many industries. Once those industries invest capital to convert to a particular pollution-control technology, they will resist future regulatory changes that require the implementation of new technologies (and further investment of capital).⁷⁹ If industries do not want to adopt new technologies, third parties will not have any incentive to research and develop new technologies.⁸⁰ Therefore, even when the EPA develops better solutions for pollution control, industry often exerts intense pressure to prevent the EPA from changing the required standard.⁸¹ This is why the use of BAT is expensive and discourages innovation, and why technology-based standards have led to a number of lawsuits.⁸² [19]

Moreover, technology-based requirements waste resources by ignoring variations among plants within an industry.⁸³ Regulations that require the use of the same technology across an entire industry do not account for variations in population density and cost differences among plants.⁸⁴ As a result, the cost-

⁷⁵ Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 33 STAN. L. REV. 1333, 1335-37 (1985).

⁷⁶ BAT is the maximum feasible pollution reduction for a given industry. Gallagher, *supra* note 26, at 148.

⁷⁷ A point source is "any discernible, confined, and discrete conveyance . . . from which pollutants are or may be discharged." 33 U.S.C. § 1362(14).

⁷⁸ Cass R. Sunstein, *Administrative Substance*, 1991 DUKE L. J. 607, 628 (1991).

⁷⁹ Cass R. Sunstein, *Paradoxes of the Regulatory State*, 57 U. CHI. L. REV. 407, 420 (1990).

⁸⁰ *Id.* at 421.

⁸¹ *Id.* at 420.

⁸² Many industries challenged BAT regulation under the CWA. *See, e.g.*, *American Petroleum Inst. v. EPA*, 858 F.2d 975 (5th Cir. 1989) (oil and gas industry); *National Ass'n of Metal Finishers v. EPA*, 719 F.2d 624 (3rd Cir. 1983) (electroplating industry); *Association of Pacific Fisheries v. EPA*, 615 F.2d 794 (9th Cir. 1983) (seafood processing industry); *American Frozen Food Inst. v. Train*, 539 F.2d 107 (D.C. Cir. 1976) (frozen food industry).

⁸³ Ackerman & Stewart, *supra* note 74, at 1336.

⁸⁴ For instance, perhaps more money should be spent in areas where more people are exposed or at those plants where a technological upgrade is the least expensive. *See* CECELIA CAMPBELL-MOHN ET

effectiveness of technology-based standards varies from region to region.⁸⁵ The EPA could achieve greater gains for the same dollar investment by targeting resources where they would be most effective, either by granting variances to individual facilities,⁸⁶ or by establishing technology-based standards as performance standards.⁸⁷ [20]

Finally, technology-based standards impose more stringent requirements on new facilities than on older, dirtier plants.⁸⁸ This disparity creates a perverse incentive for industries to operate older plants, and hence discourages the construction of newer, less polluting facilities.⁸⁹ This also discourages the development of new pollution control methods. [21]

III. COST CONSIDERATIONS AND COST-BENEFIT ANALYSIS

Regulatory decisions incorporate cost considerations in several ways. The decision-maker can disregard cost completely,⁹⁰ merely take cost into consideration,⁹¹ use cost-effectiveness analysis⁹² to determine the least expensive

AL., ENVIRONMENTAL LAW FROM RESOURCES TO RECOVERY 132 (West 1993) (decrying the inefficiency of applying uniform standards when costs of compliance vary).

⁸⁵ John D. Graham, *The Failure of Agency-Forcing: The Regulation of Airborne Carcinogens Under Section 112 of the Clean Air Act*, 1985 DUKE L. J. 100, 139 (1985).

⁸⁶ Sidney A. Shapiro & Thomas O. McGarity, *Not So Paradoxical: The Rationale for Technology-Based Regulation*, 1991 DUKE L. J. 729, 748 (1991).

⁸⁷ The MACT floor under the Clean Air Act is the average emissions level achieved by twelve percent of the best performing sources in that category. 40 C.F.R. § 63.51 (1995).

⁸⁸ For example, under the CAA, new sources must emit as little as the best controlled similar existing source, whereas existing sources must only upgrade to the average of the best twelve percent of existing similar sources.

⁸⁹ Richard B. Stewart, *Regulation, Innovation, and Administrative Law: A Conceptual Framework*, 69 CAL. L. REV. 1256, 1285 (1981).

⁹⁰ The Delaney Clause has been interpreted to forbid cost considerations in setting permissible levels of carcinogenic pesticide residues. *See infra* note 104.

⁹¹ Under the Clean Air Act, the EPA must establish residual risk standards for hazardous air pollutants that provide an "ample margin of safety," taking into account costs and other factors. 42 U.S.C. § 7412(f)(2).

⁹² Cost-effectiveness analysis uses cost to determine the least expensive method of achieving a given goal. TOM TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 82 (2d ed. 1988). With cost-effectiveness analysis, the decision-maker chooses the objective before considering

method of achieving the objective,⁹³ or formally balance costs against benefits.⁹⁴ This last method, better known as cost-benefit analysis, is unique in that it considers cost when establishing the goal as well as the method of achieving the goal.⁹⁵ Broadly defined, cost-benefit analysis is the “systematic enumeration of all benefits and all costs, tangible and intangible . . . that will accrue to all members of a society if a particular project is adopted.”⁹⁶ Cost-benefit analysis results in the implementation of those projects that provide a positive net benefit to society.⁹⁷ [22]

When cost-benefit analysis is used, it is not used to compare projects or regulations in one agency to those in another agency. Even within a single agency employing cost-benefit analysis, not all projects or regulations are compared. Most cost-benefit analysis requirements only mandate that the analysis be used for projects that will cost more than a certain amount.⁹⁸ This cost threshold requirement means that low-cost projects are not subject to cost-benefit analysis. Therefore, cost-benefit analysis does not apply to the entire menu of regulatory policy choices, limiting the value of using cost-benefit analysis. [23]

The benefits of a particular regulatory standard comprise the sum of both the damages to human health and the environmental damages that the regulation will prevent.⁹⁹ Estimating damages to human health requires determining the effects of

the cost of the alternatives. EDITH STOKEY & RICHARD ZECKHAUSER, A PRIMER FOR POLICY ANALYSIS 153 (1978).

⁹³ The federal hazardous waste cleanup program chooses the least expensive of the otherwise adequate remedial alternatives. 42 U.S.C. § 9621(b)(1) (1988 & Supp. V 1993); 40 C.F.R. § 300.430(f)(ii)(D) (1995).

⁹⁴ The Federal Insecticide, Fungicide and Rodenticide Act (“FIFRA”) permits the EPA to register only those pesticides that do not pose an “unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.” 7 U.S.C. § 136(a)(5) (1994).

⁹⁵ Cost-benefit analysis compares the benefits and costs of achieving a regulatory goal and selects an alternative that produces the best ratio of costs to benefits. If the benefits of achieving a goal do not exceed the costs of any of the alternatives, no action will be taken. JAMES T. CAMPDEN, BENEFIT, COST, AND BEYOND: THE POLITICAL ECONOMY OF BENEFIT-COST ANALYSIS 22 (1986).

⁹⁶ STOKEY & ZECKHAUSER, *supra* note 91, at 134.

⁹⁷ *Id.*

⁹⁸ The Unfunded Mandates Reform Act, *supra* note 21, and Executive Order No. 12,866, *supra* note 22, require cost-benefit analysis for projects that cost over \$100 million.

⁹⁹ BENTKOVER ET AL., *supra* note 39, at 6-11.

exposure,¹⁰⁰ the number of individuals exposed, and the cumulative costs of those effects. The costs of a given regulatory standard are the costs of changing the current standard (which may be no regulation)¹⁰¹ to a more stringent standard.¹⁰² This may be relatively easier to calculate for technology-based standards, because unlike health-based standards, technology-based standards reflect feasible technology and available cost estimates. [24]

Historically, technology-based and health-based standards have incorporated costs in differing degrees. Technology-based regulations could, but do not, require that the regulated industry adopt the most protective technology known, without regard to cost.¹⁰³ Instead, most technology-based standards explicitly consider costs.¹⁰⁴ For example, if the EPA's regulation mandated the use of a technology that did not exist, polluters could spend an infinite amount of money and still not achieve the regulatory goal. To the extent that basing a standard on an infeasible technology would require a shutdown or a zero-discharge standard, the establishment of technology-based standards without regard to engineering feasibility would also disregard costs. Therefore, whenever regulators base their choice of required technology on a proven technology, cost plays a role in setting the standard. [25]

In contrast, many health-based standards do not consider costs at all.¹⁰⁵ For instance, the Supreme Court found that in enacting the Occupational Safety and

¹⁰⁰ Human health effects include skin, eye, throat or nose irritation, cancer, damage to reproductive functions, and impairment of heart, lung, kidney or liver functions. HOPPIN, *supra* note 42, at 9.

¹⁰¹ Linda Jo Scheirow, *Senator Johnson's Proposals for Regulatory Reform: New Cost-Benefit Risk Analysis Requirements for EPA?*, 6 RISK: HEALTH, SAFETY & ENV'T 1 (1995).

¹⁰² See Cornelius M. Kerwin, *Assessing the Effects of Consensual Process in Regulatory Programs: Methodological & Policy Issues*, 32 AM. U. L. REV. 401, 402 (1983).

¹⁰³ Currently, no technology-based environmental standards completely ignore cost. Even where RCRA requires the use of BDAT, the EPA implicitly considers cost by choosing as models for the BDAT firms that have already implemented the technology. 51 Fed. Reg. 40572, 40588 (1986).

¹⁰⁴ For example, the CWA requires "economically achievable" BAT for toxic pollutants. 33 U.S.C. § 1311(b)(2)(A)(i) (1994).

¹⁰⁵ The Delaney Clause prohibits consideration of cost. The clause forbids any chemical residue on processed food that is found to "induce cancer when ingested by man or animal." 21 U.S.C. § 348(c) (1994). The Food and Drug Administration attempted to allow a "de minimis" level of risk from residues left by food coloring, but the courts found that the strict statutory language of the Delaney Clause would not allow "de minimis" risks without statutory changes. *Public Citizen v. Young*, 831 F.2d 1108, 1112 (D.C. Cir. 1987). The final blow came when the Ninth Circuit held that the EPA overstepped its statutory authority by allowing a de minimis risk given the purpose of the Delaney Clause. *Les v. Reilly*, 968 F.2d 985, 990 (9th Cir. 1992). This zero-risk limit precludes any consideration of cost.

Health Act (“OSH Act”), “Congress itself defined the basic relationship between costs and benefits, by placing the ‘benefit’ of worker health above all other considerations.”¹⁰⁶ Other health-based standards, however, do consider costs, in one of two ways. In certain situations, the regulatory body first defines the desired level of safety, then determines the acceptable level of the pollutant.¹⁰⁷ In other situations, the regulators may assign a given value to saving lives, and then balance the benefits of the regulation against its costs. Under this approach, regulators select the standard that maximizes the number of lives saved for the sum of regulatory enforcement and compliance dollars spent.¹⁰⁸ [26]

A. *Criticisms of Using a Formal Cost-Benefit Framework*

Critics of cost-benefit analysis have attacked it on both an analytical and a theoretical level. The analytical approach argues that because the benefits of health and safety regulation do not lend themselves to quantification,¹⁰⁹ calculation of costs and benefits is wholly inaccurate and cannot be used as the basis for rational decision-making.¹¹⁰ To address this concern, regulators use willingness-to-pay and

¹⁰⁶ *American Textile Mfrs. Inst. v. Donovan*, 452 U.S. 490, 509 (1980) (holding that the OSH Act did not require the agency to conduct a cost-benefit analysis before undertaking regulation). The OSH Act requires the Occupational Safety and Health Agency (“OSHA”) to set permissible exposure limits for workplace chemicals so as to provide “safe and healthful working conditions.” 29 U.S.C. § 651(b) (1994). OSHA attempted to regulate carcinogens to the lowest levels technologically and economically feasible. *Occupations Exposure to Benzene Emergency Temporary Standards*, 42 Fed. Reg. 22,526 (1977). The Supreme Court held that the Administration could ignore costs altogether, as long as it first made a finding significant risk before regulating the chemical. *Industrial Union Dept. v. American Petroleum Inst.*, 448 U.S. 607, 641 (1980).

¹⁰⁷ Prior to 1990, regulation of hazardous air pollutants under the CAA considered cost only after an initial determination of a safe level of emissions. *NRDC v. EPA*, 824 F.2d 1146, 1163-64 (D.C. Cir. 1987). See Gary E. Marchant & Dawn P. Danzeisen, “Acceptable” Risk for Hazardous Air Pollutants, 13 HARV. ENVTL. L.R. 535 (1989) (outlining possible strategies for acceptable risk decisions).

¹⁰⁸ David Stipp, *Prevention May Be Costlier Than a Cure*, WALL ST. J., July 6, 1994, at B1 (discussing a Harvard study that found that more cost-effective spending could cut health-care costs by \$31 billion).

¹⁰⁹ Measurable and quantifiable costs are included while qualitative assessments (such as the value of preservation of an endangered species or the value of saving a human life) risk being excluded from cost-benefit analyses. *CAMPDEN*, *supra* note 94, at 68.

¹¹⁰ Shapiro & McGarity, *supra* note 85, at 735-36. “Given the vast technical uncertainties and anchorless moral judgments reflected in the cost-benefit calculations for health and safety standards, basing important public policy decisions on these quantitative cost-benefit comparisons is patently unreasonable.” *Id.*

wage-risk studies to estimate the value of human lives.¹¹¹ One commentator notes that experts have tried with only limited success to calculate how much people are willing to pay to save medicinal plants, or endangered species and ecosystems.¹¹² In addition, the analytical approach argues that people rank risks differently,¹¹³ industry and other polluters may have an incentive to overestimate the costs of a given regulation,¹¹⁴ and environmental organizations may lack the resources to calculate the benefits of the regulation. Finally, the analytical approach criticizes cost-benefit analysis for the sensitivity of its results to the choice of discount rate.¹¹⁵ [27]

The theoretical approach to cost-benefit analysis argues that despite possible improvements in the quantification of costs and benefits, cost-benefit models are inherently flawed. Society perceives some outcomes (such as nuclear disaster) as so dreadful that they are unacceptable, whatever the cost. Moreover, people have a right to be free from the effects of pollution.¹¹⁶ Finally, while the choice of some regulatory alternatives may maximize net benefits to society, the public will not support the alternative if it imposes inequitable burdens on certain populations. As a possible solution to these problems, some have proposed that regulatory policy should set goals without regard to cost, and then find the most cost-effective means of meeting those goals.¹¹⁷ [28]

B. *The Changing Emphasis on Costs*

111 Steven Kelman, *Cost-Benefit Analysis: An Ethical Critique*, REGULATION, Jan.-Feb., 1981, 33, 36.

112 William K. Stevens, *Congress Asks, Is Nature Worth More Than a Shopping Mall?*, N.Y. TIMES, Apr. 25, 1995, at C4.

113 William K. Stevens, *What Really Threatens the Environment*, N.Y. TIMES, Jan. 29, 1991 at C4.

114 OFFICE OF TECHNOLOGY ASSESSMENT, PREVENTING ILLNESS & INJURY IN THE WORKPLACE 230-231 (1985) (noting OSHA vinyl chloride compliance costs were estimated at \$65-90 billion, but only resulted in actual costs of \$100-200 million).

115 Discount rate is the analysts' estimate of the likely interest rate over the period of analysis. The interest rate is used to determine the time value of money. See Daniel A. Farber & Paul A. Hemmersbaugh, *The Shadow of the Future: Discount Rates, Later Generations, and the Environment*, 46 VAND. L. REV. 267, 291 (1993) (showing the relationship between the implicit value of a human life and the choice of discount rate in a nuclear waste repository example).

116 Kelman, *supra* note 110, at 33.

117 Michael S. Baram, *Cost-Benefit Analysis: An Inadequate Basis for Health, Safety and Environmental Regulatory Decisionmaking*, 8 ECOLOGY L.Q. 377, 377-78 (1980) (finding that regulatory use of cost-benefit analysis thwarts legislative health and safety goals).

Cost considerations did not play a major role in early environmental regulation. Congress debated whether plant closings and economic dislocation constituted an acceptable price for a cleaner environment,¹¹⁸ and usually enacted legislation that left the determination of appropriate levels of safety to the EPA.¹¹⁹ This created an incentive for the President to limit the political fallout from the public perception that costly environmental regulations were executive branch policy.¹²⁰ [29]

Presidents Reagan and Clinton each have issued executive orders requiring agencies to use cost-benefit analysis in regulatory decision-making, to the extent that it does not conflict with other statutory requirements.¹²¹ Beginning in the 1980s, the executive branch marshaled the efforts of the Office of Management and Budget (“OMB”), which organized a new Office of Information and Regulatory Affairs (“OIRA”).¹²² Under the authority of executive order, OIRA required agencies to consider the costs of proposed regulations in a regulatory impact analysis as part of the rule-making process.¹²³ Consolidation of OMB power led to complaints that the executive branch was intentionally stalling the implementation of Congressional health and safety mandates.¹²⁴ Perhaps in response to this display of executive

118 See Comment, *Water Quality Standards, Maximum Loads, and the Clean Water Act: The Need for Judicial Enforcement*, 34 HASTINGS L.J. 1245, 1250 (1985).

119 Both the CAA and the CWA require the regulation of discharges to “an ample margin of safety,” leaving the determination of “safety” and “ample” to the EPA. 42 U.S.C. § 7412 (f)(2), 33 U.S.C. § 1317(a) (1994).

120 Christopher C. DeMuth & Douglas H. Ginsburg, *White House Review of Agency Rulemaking*, 99 HARV. L. REV. 1075, 1079 (1986) (examining the increased role of high-level White House officials in regulatory decision-making).

121 Exec. Order No. 12291, 3 C.F.R. 127 (1982) (Reagan’s executive order requiring the benefits of regulation to outweigh the costs); Exec. Order No. 12498, 50 C.F.R. 1036 (1985) (Reagan’s executive order requiring Office of Management and Budget review of all new regulations); Exec. Order No. 12866, *supra* note 20 (Clinton’s executive order requiring regulatory review and agency determination that regulatory benefits justify its costs).

122 OIRA handles the methodological issues surrounding regulatory decision making within OMB. Executive Order 12866 § 2(b), *supra* note 22.

123 Alan B. Morrison, *OMB Interference With Agency Rulemaking: The Wrong Way to Write a Regulation*, 99 HARV. L. REV. 1059, 1066-67 (1986) (criticizing OMB review for stifling agency action).

124 Jeffrey H. Howard & Linda E. Benfield, *Rulemaking in the Shadows: The Rise of OMB and Cost-Benefit Analysis in Environmental Decision Making*, 16 COLUM. J. ENVTL. L. 143, 152 (1991) (decrying the delays imposed on the regulation of asbestos, which was clearly hazardous).

branch power, some of the newer statutes enacted by Congress contain language that specifies when agencies may and may not consider costs.¹²⁵ [30]

Ignoring the cost implications of environmental policy has become politically infeasible given the drive for reduced government.¹²⁶ Proposals to graft cost considerations onto environmental regulatory decisions constitute part of the Republican party's political platform.¹²⁷ In addition, Congress has enacted the Unfunded Mandates Reform Act, which requires agencies to conduct a "qualitative and quantitative assessment of the anticipated costs and benefits" of any proposed regulation that could cause state governments or the private sector to spend more than \$100 million a year.¹²⁸ Finally, the House of Representatives has passed legislation that would require the EPA to certify that the benefits of a proposed regulation are "likely to justify, and be reasonably related to" the costs of the regulation.¹²⁹ [31]

To understand the consequences of these changes, the next two sections of this Note discuss the evolution of health-based and technology-based standards under the Clean Air Act and the Clean Water Act, and analyze how cost-benefit analysis might affect their implementation. [32]

IV. THE CLEAN AIR ACT

¹²⁵ For example, the Clean Water Act requires the EPA to weigh costs and benefits when selecting best practicable control technology ("BPCT") but not when selecting BAT. 33 U.S.C. § 1314(b)(1) (1994).

¹²⁶ Even the Clinton administration tried to head off Republican moves to deregulate with the executive deregulation initiative. Frank Clifford, *Does Earth Still Need Protection?*, L.A. TIMES, Apr. 22, 1995, at A1, A27 (noting the administration's exemptions for small land owners from some CWA and Endangered Species Act provisions).

¹²⁷ The Contract with America, introduced in the House of Representatives as the Job Creation and Wage Enhancement Act of 1995, would have created statutory requirements for cost-benefit analysis. H.R. 9, 104th Cong., 1st Sess. § 324 (1995).

¹²⁸ Unfunded Mandates Reform Act of 1995 § 202(a)(2), *supra* note 21.

¹²⁹ Risk Assessment and Cost-Benefit Act of 1995, H.R. 1022 104th Cong., 1st Sess., § 202(a)(2) (1995). This measure passed the House on February 28, 1995, and was referred to the Senate, which has yet to take action on it.

Congress passed the Clean Air Act in 1970,¹³⁰ requiring the EPA to establish National Ambient Air Quality Standards (“NAAQS”)¹³¹ for air pollutants, and requiring the states to develop implementation and maintenance plans.¹³² The CAA regulates air pollution in three ways: (1) the CAA authorizes the EPA to promulgate hazardous air pollutant emissions standards for stationary sources;¹³³ (2) stationary sources such as factories or power plants must obtain permits to discharge air pollutants;¹³⁴ and (3) the CAA authorizes the EPA to regulate automobile emissions.¹³⁵ Congress extended the CAA’s deadlines for implementation in 1977 and in 1990,¹³⁶ when it added a sulfur dioxide emissions permit trading program¹³⁷ to control acid deposition.¹³⁸ [33]

NAAQS are federal standards enacted to limit ambient air pollutants.¹³⁹ NAAQS are divided into primary and secondary NAAQS; primary NAAQS require the EPA to determine what constitutes a hazardous pollutant, and then set standards that provide an “adequate margin of safety” to “protect public health.”¹⁴⁰ In contrast, secondary NAAQS only require protection from any “known or anticipated adverse effects” from ambient pollutants.¹⁴¹ The EPA sets these

130 Pub. L. No. 91-604, 84 Stat. 1676 (1970) (codified at 42 U.S.C. § 7401).

131 42 U.S.C. § 7409 (providing a national ambient acceptable measurement for six criteria pollutants).

132 *Id.* §§ 7410, 7410(a)(1) (requiring state plans to implement, maintain and enforce ambient air quality standards).

133 *Id.* § 7412.

134 *Id.* § 7410(j).

135 *Id.* §§ 7521-7590.

136 Pub. L. No. 95-95, 91 Stat. 685 (1977); Pub. L. No. 101-549, 104 Stat. 2399 (1990).

137 The emissions permit trading program allows entities with permits to save unused emissions credits, which they can later use or sell. 42 U.S.C. § 7651(b) (1988 & Supp. V 1993).

138 The CAA did not regulate acid deposition, more commonly called acid rain, until 1977 because the use of state implementation plans did not regulate transboundary pollution. WILLIAM MURRAY TABB & LINDA A. MALONE, ENVIRONMENTAL LAW: CASES AND MATERIALS 382 (1994).

139 42 U.S.C. § 7409(b)(1).

140 *Id.*

141 42 U.S.C. § 7409(b)(2).

secondary standards to protect public environmental and economic welfare, including recreational and industrial concerns.¹⁴² [34]

The CAA does not require the EPA to “consider economic and technological feasibility in setting air quality standards. . . . [This] was the result of a deliberate decision by Congress to subordinate such concerns to the achievement of health goals.”¹⁴³ NAAQS have been criticized for their aspirational nature.¹⁴⁴ Over the years, the EPA has promulgated only six NAAQS, for sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.¹⁴⁵ [35]

A. Health-Based Hazardous Air Pollutant Regulation

In 1970, the CAA authorized the EPA to establish National Emissions Standards for Hazardous Air Pollutants (“NESHAPs”) to provide an “ample margin of safety.”¹⁴⁶ But because the statute did not expressly give the EPA the discretion to consider cost or technological feasibility, EPA officials were reluctant to include NESHAPs in regulations.¹⁴⁷ The scientific models that were used to determine the carcinogenic effects of pollutants assumed that exposure to carcinogens at any level would cause cancer, so that the EPA could establish no safe level for many chemicals.¹⁴⁸ The political unpopularity of setting zero-emissions limitations for carcinogens, combined with scientific uncertainty, hobbled EPA decision-making.¹⁴⁹ Between 1970 and 1990, the EPA promulgated only eight hazardous air pollutant regulations: asbestos, benzene, beryllium, mercury, vinyl chloride, coke oven

¹⁴² GARY C. BRYNER, *BLUE SKIES, GREEN POLITICS: THE CLEAN AIR ACT OF 1990*, 192 (1993).

¹⁴³ *Lead Industries Ass’n v. EPA*, 647 F.2d 1130, 1149 (D.C. Cir. 1980).

¹⁴⁴ See David Schoenbrod, *Goals Statutes or Rules Statutes: The Case of the Clean Air Act*, 30 U.C.L.A. L. REV. 740, 751 (1983).

¹⁴⁵ 40 C.F.R. § 50.4-12 (1994).

¹⁴⁶ 42 U.S.C. §§ 7412(c)(2), 7412(d)(4).

¹⁴⁷ *Clean Air Act (Part 2): Hearings Before the Subcomm. on Oversight and Investigations of the House Comm. on Energy & Commerce, 97th Cong., 1st Sess.* 737 (1981) (statement of Walter C. Barber, Jr., Director, Office of Air Quality Planning and Standards, EPA)

¹⁴⁸ Guidelines for Carcinogen Risk Assessment, *supra* note 2, at 33992, 33998.

¹⁴⁹ William A. Wichers II et al., *Regulation of Hazardous Air Pollutants Under the New Clean Air Act: Technology-Based Standards at Last*, 22 ENVTL. L. REP. 10717, 10718 (1992).

emissions, arsenic, and radionuclides.¹⁵⁰ Political pressure from industry further stifled agency action.¹⁵¹ [36]

The EPA promulgated NESHAPs so slowly that environmentalists had to make use of the CAA's citizen-suit provisions to force the listing of hazardous air pollutants ("HAPs").¹⁵² The D.C. Circuit ultimately ruled that the determination of "safe" must take place without regard to cost or technological feasibility, but that the EPA could consider these factors in establishing an ample margin of safety.¹⁵³ Congress, unhappy with the EPA's failure to promulgate NESHAPs, amended the CAA in 1990 and added technology-based provisions for the regulation of hazardous air pollutants.¹⁵⁴ [37]

B. *Hybrid Health-Based and Technology-Based Regulation*

In the 1990 amendments to the CAA, Congress listed 189 hazardous air pollutants for source category regulation by the EPA.¹⁵⁵ Congress also required the EPA to promulgate maximum achievable control technology ("MACT") standards for each category, to provide the "maximum degree of emissions reductions" determined achievable.¹⁵⁶ These MACT emissions limitations represent "the maximum degree of reduction in emissions of hazardous air pollutants (including a prohibition on such emissions, where achievable) . . . taking into consideration the cost of achieving such emission reductions . . ." ¹⁵⁷ The EPA has interpreted MACT to (1) require existing sources to achieve an emissions level that is comparable to the average emissions of twelve percent of the best performing sources,¹⁵⁸ and (2) require new sources to meet the emissions level achieved in practice by the best

150 JEFFREY M. GABA, ENVIRONMENTAL LAW 131 (1994).

151 Graham, *supra* note 84, at 131.

152 See NRDC v. Thomas, 689 F.Supp. 246, 249 (S.D.N.Y. 1988).

153 NRDC v. EPA, 824 F.2d 1146, 1165 (D.C. Cir. 1987) (finding that Congress did not intend the EPA to set zero-risk standards, but to find a level of acceptable risk).

154 The health-based approach applied to the eight hazardous air pollutants already regulated, but new decisions would be technology-based. 42 U.S.C. § 7412(b)(2)(d)(3).

155 Source categories are industrial groups, such as petroleum refining or coke production, that the CAA regulates similarly because of their common emissions. 42 U.S.C. § 7412(c)(1).

156 42 U.S.C. § 7412(d)(2).

157 40 C.F.R. § 63.51 (1994).

158 *Id.*

controlled similar source.¹⁵⁹ The EPA gives facilities that must meet other technology standards (either because they are located in nonattainment areas,¹⁶⁰ or to prevent significant deterioration)¹⁶¹ an additional five years to meet MACT standards.¹⁶² [38]

MACT differs from other technology-based standards such as BDAT or BAT. First, the MACT standards do not specify what type of technology a polluter must use, only that a polluter must achieve the same emissions reductions as the least polluting facilities in the same industry. This allows a more flexible performance-based technology standard, which eliminates some of the economic inefficiencies associated with BDAT and BAT standards. Second, Congress has protected health-based goals by overlaying a health-based standard on top of MACT. If Congress itself does not legislate to control residual health risks, or if MACT standards leave a residual cancer risk of greater than one in one million, the EPA must assess the need for further regulation to provide an ample margin of safety, “taking into consideration costs, energy, safety and other relevant factors.”¹⁶³ In cases where the risks do not exceed one in one million, the EPA will not promulgate additional residual risk standards.¹⁶⁴ This residual risk standard serves as a check mechanism for the technology-based standards: if the risks remaining after MACT implementation are unacceptable, the EPA will impose additional standards. [39]

C. *Current Implementation and Cost-Benefit Analysis*

159 *Id.*

160 Sources in nonattainment areas must achieve the lowest achievable emissions rate contained in a state implementation plan, or “the most stringent emissions limitation which is achieved in practice.” 42 U.S.C. § 7501(3).

161 New sources built in Class I areas requiring special protection must use “the best available control technology.” 42 U.S.C. § 7475(a)(4).

162 42 U.S.C. § 7412(i)(6).

163 42 U.S.C. § 7412(f)(2).

164 Delisting of Source Category and Revision of Initial List of Categories of Sources & Schedules for Standards Under Section 112(c) of the Clean Air Act, 60 Fed. Reg. 61550, 61551 (1995).

The EPA has promulgated MACT standards for several industries¹⁶⁵ under existing cost-benefit requirements.¹⁶⁶ In its analysis justifying recent MACT standards for petroleum refineries, the EPA noted that the regulation would eliminate less than one cancer per year.¹⁶⁷ The EPA also found “[t]he quantification of dollar benefits for all benefit categories is not possible at this time because of limitations in both data and available methodologies.”¹⁶⁸ Nevertheless, even excluding the benefit of the cancer reductions from its analysis, the EPA found that the benefits of the regulation exceeded annual compliance costs by \$29.8 million.¹⁶⁹ In contrast to the petroleum-industry regulations, NESHAPs for ship building did not require either regulatory-impact or cost-benefit analysis,¹⁷⁰ because the rule did not trigger the \$100-million cost threshold. [40]

The implementation of these two standards demonstrates some of the major difficulties regulators will encounter in imposing a cost-benefit framework on the regulation of hazardous air pollutants. First, regulators find it difficult to quantify environmental benefits, especially ecological or non-human health benefits. Thus, some regulations that appear to have fewer benefits than costs may be rejected only because analysts have underestimated their benefits. Second, due to the \$100-million threshold for cost-benefit analysis, those regulations not meeting the threshold will not be subject to the same type of analysis.¹⁷¹ [41]

Moreover, cost-benefit analysis will change the way the EPA calculates residual-risk standards. As noted earlier, if MACT standards leave a residual cancer risk of greater than one in one million, the EPA must promulgate additional

¹⁶⁵ See, e.g., 60 Fed. Reg. 43244 (1995) (to be codified at 40 C.F.R. pts. 9, 60, & 63) (regulating hazardous air pollution emissions from petroleum refineries); 60 Fed. Reg. 45948 (1995) (to be codified at 40 C.F.R. pts. 9 & 63) (regulating hazardous air pollution emissions from aerospace manufacturing); 60 Fed. Reg. 62930 (1995) (to be codified at 40 C.F.R. pts. 9 & 63) (regulating hazardous air pollution emissions from wood furniture manufacturing).

¹⁶⁶ As previously noted, Congress enacted legislation last year requiring cost-benefit analysis for new major rules. See The Unfunded Mandates Reform Act § 202(a)(2), *supra* note 21.

¹⁶⁷ National Emission Standard for Hazardous Air Pollutants: Petroleum Refineries, 60 Fed. Reg. 43244, 43245 (1995) (to be codified at 40 C.F.R. pts. 9, 60, & 63).

¹⁶⁸ *Id.*

¹⁶⁹ *Id.* at 43246.

¹⁷⁰ National Emission Standard for Hazardous Air Pollutants for Shipbuilding and Ship Repair (Surface Coating) Operations, 60 Fed. Reg. 64330 (1995) (to be codified at 40 C.F.R. pt. 63).

¹⁷¹ This is not to say that all regulations should be subject to an expensive and time consuming cost-benefit analysis. Requiring a cost-benefit analysis for every minor agency decision would impede the rule-making process.

regulations to provide an ample margin of safety.¹⁷² The use of cost-benefit analysis will require the EPA to base its residual-risk determination on population risk as well as on individual risk. [42]

Courts have already found that Congress expressly forbade the EPA from considering costs when setting aspirational NAAQS.¹⁷³ The proposed regulatory reform bill does not specifically supersede the NAAQS' exclusion, but the popularity of cost-benefit analysis will affect the EPA's approach to NAAQS. The EPA will most likely be unable to certify that the benefits of new ambient standards exceed or justify their costs, because by their nature aspirational goals are not necessarily currently achievable. [43]

V. THE FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT)

Congress enacted the Clean Water Act in 1972.¹⁷⁴ Since then, Congress has repeatedly amended the CWA, most significantly in 1987.¹⁷⁵ Unlike the CAA, the CWA does not set ambient water-quality standards. Instead, the CWA requires states to classify their bodies of water according to designated uses,¹⁷⁶ and requires the EPA to establish water-quality criteria (permitted levels of pollutants) for each of those uses.¹⁷⁷ EPA regulations require water-quality standards to consider the water's use for "public water supplies, propagation of fish, shellfish, wildlife, recreation . . . and agricultural, industrial and other purposes including navigation."¹⁷⁸ [44]

The CWA also established the national pollution discharge elimination system, which requires facilities to obtain a permit from the EPA, or from the state,

¹⁷² 42 U.S.C. § 7412(f)(2).

¹⁷³ *Lead Industries Ass'n*, 647 F.2d at 1149.

¹⁷⁴ Federal Water Pollution Control Act, Pub. L. No. 92-500, 86 Stat. 816 (1972) (codified as amended in scattered sections of 33 U.S.C.).

¹⁷⁵ Water Quality Act of 1987, Pub. L. No. 100-4, 100 Stat. 7 (1987) (codified as amended in scattered sections of 33 U.S.C.).

¹⁷⁶ 33 U.S.C. § 1313(d)(1)(A) (1994).

¹⁷⁷ *Id.*

¹⁷⁸ 40 C.F.R. § 130.03 (1995).

before discharging pollutants into navigable waters.¹⁷⁹ The EPA requires states to regulate point-source discharges¹⁸⁰ such that cumulative discharges do not exceed the water-quality standards for the water body's designated use.¹⁸¹ Like the CAA, the CWA grants variances in certain circumstances.¹⁸² [45]

A. Regulation of Toxic Pollutants

The CWA requires the EPA to list toxic pollutants and to set final standards that provide "an ample margin of safety."¹⁸³ In 1978, the Circuit Court for the District of Columbia ("D.C. Circuit") upheld the EPA's decision to regulate contaminants with no regard to cost.¹⁸⁴ This preclusion of cost consideration paralyzed the agency, which found it politically impossible to require an entire industry to close.¹⁸⁵ As a result, the EPA listed only nine pollutants, drawing a second attack by environmentalists.¹⁸⁶ When the EPA attempted another listing of toxic pollutants, adjudicatory hearings revealed stark weaknesses in the data, and the EPA conceded that the science of the proposals "could not be defended."¹⁸⁷ [46]

¹⁷⁹ 33 U.S.C. § 1342(a) (1994) (requiring that permits meet effluent limitation guidelines). With the EPA's approval, states may promulgate their own pollution discharge plans. 33 U.S.C. § 1342(b) (requiring state plans to comply with effluent limitation guidelines).

¹⁸⁰ Point sources have been interpreted broadly to include any point where a pollutant enters the waters of the United States. See *United States v. Earth Sciences, Inc.*, 599 F.2d 368, 373 (10th Cir. 1979). Typically, point sources are contrasted with nonpoint sources, such as agricultural runoff, which are sources of pollution that cannot be mitigated at a single point. Gallagher, *supra* note 26, at 159.

¹⁸¹ 40 C.F.R. § 131.11 (1995).

¹⁸² The EPA may grant variances for facilities that exhibit fundamentally different factors such as control techniques, energy requirements, and operating methods. Prohibitive costs experienced by an individual polluter are also considered fundamentally different factors. 33 U.S.C. § 1311(n), § 1314(b).

¹⁸³ 33 U.S.C. § 1317(a)(4). Congress modeled the "ample margin of safety" language after the Clean Air Act's hazardous air pollutant provisions, signaling the EPA to err on the side of safety. Oliver A. Houck, *The Regulation of Toxic Pollutants Under the Clean Water Act*, 21 ENVTL. L. REP. 10528, 10533 (1991).

¹⁸⁴ *Hercules, Inc. v. EPA*, 598 F.2d 91, 111 (D.C. Cir. 1978) (finding no requirement for the agency to consider cost or technological feasibility); see also *EDF v. EPA*, 598 F.2d 62, 67 (D.C. Cir. 1978) (finding zero-discharge limits for PCBs to be within the agency's discretion given scientific uncertainty).

¹⁸⁵ William Ruckelshaus, *Risk in a Free Society*, 14 ENVTL. L. REP. 10190, 10192 (1984).

¹⁸⁶ *NRDC v. Train*, 519 F.2d 287, 288 (D.C. Cir. 1975) (finding the EPA's failure to produce a reviewable record in listing toxic pollutants to be an abuse of discretion).

¹⁸⁷ 41 Fed. Reg. 23576, 23577 (1976) (codified at 40 C.F.R. pt. 129) (noting data gaps concerning identification and extent of pollution).

B. *Technology Based Standards to Combat Toxics*

After an unsuccessful attempt to promulgate health-based standards, and a third lawsuit by environmentalists to compel action, in 1975 the EPA finally agreed to regulate toxic discharge under the CWA on the basis of technology.¹⁸⁸ Congress formally approved this new approach in the 1977 Clean Water Act Amendments.¹⁸⁹ The CWA now directs the EPA to apply the “best available technology economically achievable” for each source category.¹⁹⁰ The BAT standard takes into account the age of equipment, the processes involved, the engineering aspects, and the costs of achieving effluent reductions.¹⁹¹ Although the EPA considers costs in its BAT decision,¹⁹² the D.C. Circuit has not interpreted BAT to require the benefits to outweigh the costs.¹⁹³ [47]

Because BAT standards are difficult to achieve, Congress also created a less stringent set of technology-based standards as interim goals. These best practicable control technology (“BPCT”) standards specifically require the EPA to consider “the total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application.”¹⁹⁴ In other words, the EPA must conduct a cost-benefit balancing test. Courts, however, have granted the EPA significant deference when evaluating its cost-benefit balancing:¹⁹⁵ before the EPA chooses a technology under the BPCT it must only show that the increased costs of going to BAT are “wholly disproportionate” to the benefits.¹⁹⁶ [48]

188 NRDC v. Train, 396 F. Supp. 1393, 1396 (D.D.C. 1975).

189 33 U.S.C. § 1317(a)(1).

190 33 U.S.C. § 1311(b)(2)(A)(i).

191 33 U.S.C. § 1314(b)(2)(B).

192 American Iron & Steel Inst. v. EPA, 568 F.2d 284, 297 (3rd Cir. 1977).

193 Weyerhaeuser Co. v. Costle, 590 F.2d 1011, 1027 (D.C. Cir. 1978).

194 33 U.S.C. § 1314(b)(1)(B). The EPA sets the BPCT at the level of performance achieved by the best existing plants in a given source industry, or other industry if necessary. Tanners’ Council of America, Inc. v. Train, 540 F.2d 1188, 1193 (4th Cir. 1976).

195 See, e.g., American Petroleum Inst. v. EPA, 540 F.2d 1023 (10th Cir.), cert. denied 430 U.S. 922 (1976) (holding that where the EPA conducted a comprehensive study of the costs of compliance, the choice of the point of diminishing returns was within agency discretion).

196 Association of Pacific Fisheries v. EPA, 615 F.2d 794, 805 (9th Cir. 1980) (allowing regulations establishing best available control technology economically achievable based on statistics from a single plant).

The EPA currently interprets BAT to require that for many source categories “there shall be no discharge of process wastewater pollutants into navigable waters.”¹⁹⁷ Different processes of a particular industry may be regulated differently.¹⁹⁸ Finally, the EPA has set BAT and BPCT at the same level for some processes,¹⁹⁹ while at the same time they are quite different for others.²⁰⁰ [49]

C. *Implementation Under Proposed Amendments*

Last May the House of Representatives passed a bill that would impose a cost-benefit requirement on any standard promulgated under the CWA that would result in an annual cost increase of \$25 million or more.²⁰¹ The amendments would require the EPA to certify that any new regulation “maximizes net benefits to society.”²⁰² The House of Representatives proposed these new decision criteria to “supplement and, to the extent there is a conflict, supersede the decision criteria otherwise applicable under this Act.”²⁰³ [50]

Enactment of this balancing requirement would alter the consideration of cost in BAT decisions by imposing a cost-benefit balancing approach where the courts have found that the current statute does not require cost-benefit balancing.²⁰⁴ Rather than only using cost-benefit analysis to justify not going to the higher standard of BAT, the EPA would now have to use cost-benefit analysis to justify any new standard. This would eliminate the technology forcing mechanism of the

¹⁹⁷ See generally 40 C.F.R. § 426.13 (1995) (fiberglass manufacturing); 40 C.F.R. § 427.13 (asbestos and cement pipe manufacturing); 40 C.F.R. § 429.33 (timber products wood veneer processing).

¹⁹⁸ For example, BAT regulations for different parts of the glass manufacturing industry differ from each other: fiberglass manufacturing requires no discharge, while production of television tubes allows discharges of lead and fluoride. 40 C.F.R. § 426.113 (1995).

¹⁹⁹ The EPA requires manufacturers of calcium carbide to meet both a BAT and a BPCT standard requiring no discharge of pollutants. 40 C.F.R. §§ 415.32-33 (1995).

²⁰⁰ For example, the EPA set the BAT at a more stringent level than the BPCT for the petroleum refining topping subcategory, by eliminating allowable discharges of biological oxygen demand, oil and grease, phenolic compounds, and total chromium under BAT. 40 C.F.R. §§ 419.12-13 (1995).

²⁰¹ Federal Water Pollution Control Act Amendments of 1995, H.R. 961, 104th Cong, 1st Sess. § 324(a)(1) (1995). This measure passed the House on May 16, 1995, and moved to the Senate, which has yet to act on the measure.

²⁰² *Id.*

²⁰³ *Id.* § 324(a)(2).

²⁰⁴ *Weyerhaeuser Co.*, 590 F.2d at 1045.

BAT/BPCT distinction. Finally, cost-benefit analysis could also interfere with the setting of water-quality criteria. Although the EPA bases water-quality criteria on human health standards, it often bases them on the health of aquatic species as well. The EPA may have difficulty in quantifying the benefits of an aquatic species and the recreational value of the water body. [51]

VI. CONCLUSION

Some technology-based and health-based standards serve aspirational purposes, such as BAT standards under the Clean Water Act and NAAQS under the Clean Air Act. Under the 1990 amendments to the Clean Air Act, health-based residual risk standards serve as triggers for additional regulation, such as the residual-risk hazardous air pollutant standards. Finally, some standards, such as the MACT and BPCT standards, have proven themselves implementable. All of these standards serve different functions and should receive different treatment under a cost-benefit framework. [52]

The EPA should subject implementable technology-based standards to a strict cost-benefit analysis, one that requires benefits to exceed costs, or at the very least justify costs. Technology-based standards have traditionally incorporated costs and are feasible because regulators use existing technology as their basis. Here, cost-benefit analysis would ensure that polluters did not install inefficient technologies. Even now, however, the EPA can partially remedy economic inefficiencies by making technology-based standards performance standards and by using a system of variances. These revisions do not alter the fact that technology-based standards may not achieve health-based goals nor spur technological development. [53]

In order to protect health and encourage innovation, other standards are needed. Aspirational standards spur technological research and development. The EPA should not subject such aspirational health-based and technology-based standards to a strict cost-benefit requirement. Aspirational standards are inherently inefficient, but they foster important goals; requiring them to meet a cost-benefit test would defeat their aspirational purpose. [54]

Congress has legislated that certain levels of residual risk from hazardous air pollutants after MACT implementation are unacceptable. Cost-benefit balancing would enhance this check mechanism. Imposing a cost-benefit analysis would require basing residual-risk standards on the more realistic population risk instead of individual risk. For these health-based standards, the line of acceptable risk should be drawn where benefits justify costs. When benefits do not justify costs, the risk has not yet crossed the line to unacceptable. [55]

Inefficient regulatory decisions require strong reasoning and a deliberative thought process. Although cost-benefit analysis serves an efficiency goal, the components of cost-benefit analysis are still developing. Researchers' inability to predict risks, or to quantify the benefits of avoiding them, plagues current cost-benefit analyses. Given the quest for a more efficient regulatory apparatus, we must ensure that the imposition of efficiency tools encourages technological development and avoids the most harmful risks. Only through careful use of cost-benefit analysis can our environmental regulatory policy achieve these multiple goals. [56]