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How the EPA may be Selling General Electric Down the River- A Law AND Economics Analysis of the $460 Million Hudson River Cleanup Plan

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COMMENT

HOW THE EPA MAY BE SELLING GENERAL ELECTRIC DOWN THE RIVER: A LAW AND ECONOMICS ANALYSIS OF THE $460 MILLION HUDSON RIVER CLEANUP PLAN

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INTRODUCTION

After more than a decade of fighting the Environmental Protection Agency ("EPA") on whether polychlorinated biphenyls ("PCBs") are harmful to humans and how most efficiently to clean them up, General Electric Company ("GE") and recently retired Chairman Jack Welch are finally facing their worst nightmare—a federally mandated cleanup of $460 million.[1] On August 1, 2001, the EPA Administrator Christie Whitman decided to move forward with the EPA's plan to dredge the Upper Hudson River to remove PCB-contaminated sediments.[2] The EPA decision came after a public-comment period on the proposed plan for the PCB-contaminated

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1. Cindy Skrzycki, *GE Ads Zap the EPA over PCB Cleanup*, WASH. POST, July 24, 2001, at E01.

2. *Id.*

sediments in the Upper Hudson River, which closed April 17, 2001.[3] During this time, the EPA received over 70,000 comments, including approximately thirty-eight boxes of written comments and over 35,000 e-mails.[4] The decision was the culmination of a long drawn out battle between environmental groups and GE. Despite GE's multi-million dollar public relations campaign, spanning television and radio commercials, newspapers, infomercials, and a video documentary, the EPA has mandated GE to clean up the Hudson River.[5]

The EPA's decision to go forward with dredging remains controversial. Although conflicting scientific studies, especially in the case of PCBs often give rise to controversy, this Note will demonstrate that a cost-benefit analysis proves the decision to dredge an unacceptable remedy regardless of its purported scientific validity. This Note analyzes the seemingly endless studies on the environmental and economic costs of PCB pollution and the costs of rehabilitating the Hudson River.

Economics offers a way to reconcile the two, providing a methodology for evaluating whether the EPA's decision to dredge the Hudson is proper. A cost-benefit analysis that considers the problems dredging poses to surrounding counties and recreational users of the Hudson, and accounting for future benefits provides a different answer to the question of whether the EPA's decision is appropriate. Part I of this Note provides a background of PCB pollution in the Hudson River, the history of rehabilitation, and the regulatory framework surrounding the EPA's decision. This Part also sets forth the regulatory framework of this decision, specifically referencing the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA"). Part II discusses the cost benefit methodology and briefly explains the background of law and economics. Part III analyzes the cost-benefit analysis of the available rehabilitation alternatives, including uncertainty and discounting. Part IV explains the problems

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3. *See* Press Release, EPA, EPA Extending Time for Public Comments on Proposed Plan to Clean Up Hudson River PCBs (Jan. 18, 2001), *available at* http://www.epa.gov/region02/news/01010.htm (last visited May 15, 2002).

4. *Id.*

5. Skrzycki, *supra* note 1.

associated with future costs inherent in a massive construction operation. This note concludes by demonstrating that under a cost-benefit analysis, dredging is an improper solution to the PCB contamination of the Hudson River.

I. BACKGROUND OF PCB POLLUTION IN THE UPPER HUDSON RIVER

A. *What are PCBs?*

Polychlorinated biphenyls are part of a class of organic chemicals known as chlorinated hydrocarbons.[6] For nearly 50 years, one billion pounds of PCB's were legally manufactured, sold, used and discharged throughout the United States.[7] In 1977, all prior legal uses of PCBs were prohibited under the Toxic Substances Control Act ("TSCA").[8] The EPA classified them as probable human carcinogens due primarily to their toxic, neurological and developmental effects.[9] PCB's enter the aquatic wildlife of the Hudson River through the process of bioaccumulation, in which chemicals "trickle up" through the food chain.[10] Each chemical gets progressively toxic as fish or birds accumulate the PCB's of its prey found in tissues and internal organs.[11] In light of this, in 1975, the New York State Department of Health ("NYSDOH") issued health advisories limiting the consumption of fish from the Upper Hudson River.[12] To this day, the NYSDOH continues to issue health advisories for fish in the Upper Hudson River and recommends that

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6. Hudson Voice, Frequently Asked Questions, *at* http://www.hudsonvoice.com/auxiliary/faqs/faqs.html (last visited May 15, 2002).

7. *Id.*

8. EPA, HUDSON RIVER PCBS SUPERFUND SITE 5 (2000) [hereinafter HUDSON RIVER PCBS], *available at* http://www.epa.gov/hudson/proposedplan.pdf (last visited May 15 2002).

9. EPA, PCBs and Human Health, *at* http://www.epa.gov/hudson/humanhealth.htm (last visited May 15, 2002).

10. EPA, Hudson River PCBs Glossary and Frequently Asked Questions, *at* http://www.epa.gov/hudson/glossary.htm (last visited May 15, 2002).

11. *Id.*

12. HUDSON RIVER PCBS, *supra* note 8.

women of childbearing age and children under the age of 15 not eat fish throughout the entire Superfund site.[13] In 1976, a ban on fishing from Hudson Falls to the Federal Dam at Troy was implemented by the NYSDEC due to the possible risks associated with PCB contamination.[14] Commercial fishing of striped bass that migrate into the Lower Hudson River was also banned. Although the NYSDEC lifted the ban on fishing in the Upper Hudson River in favor of a catch and release program in 1995, the ban on commercial fishing in the Lower Hudson River continues.[15]

PCB's have been found from Hudson Falls to the Battery in New York City, a 200-mile stretch.[16] The new PCB's were probably discharged from two GE plants in Fort Edward and Hudson Falls, New York.[17] These plants are the primary culprits for discharging an estimated one million pounds of PCB's into the river over a thirty-year period.[18] Because of the enormity of PCB contamination, the Hudson River was declared a Superfund site in 1983.[19] The PCBs were primarily concentrated to fine sediments behind the Fort Edward Dam until the Dam was removed in 1973, and the contaminated sediments were washed downstream, causing environmental harm.[20] To determine the extent of PCB contamination, a study was conducted in which 40 hot spots were discovered between Fort Edward and the Troy Dam.[21] A study by the New York Department of Environmental Conservation ("NYDEC") found that these hot spots had an average PCB concentration of 50 parts per million ("ppm").[22] It is this 40-mile stretch of the Hudson River that is being considered for cleanup by the EPA.[23]

GE used PCB's as an insulator for electrical capacitors because they withstood high temperatures, would not burn, and at the time

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13. *Id.*
14. *Id.*
15. *Id.*
16. *Id.*
17. *Id.*
18. *Id.*
19. *Id.*
20. *Id.*
21. *Id.*
22. *Id.*
23. *Id.*

were thought to be safe.[24] GE at all times had the proper federal and state government permits for their "miracle" chemical, including the discharge of the PCB's into the plant's waste stream, which eventually led into the Hudson River.[25] Industrial materials containing PCB's were generally looked upon favorably and were used in wooden factories, schools, and other buildings in which fire was a threat.[26]

B. *Rehabilitation History*

In 1975, NYSDEC brought administrative proceedings against GE for the contamination of the Hudson and sought an order directing GE to cease discharge of PCBs, and pay restoration and cleanup costs.[27] General Electric and the NYSDEC eventually entered into a settlement agreement, which released GE from responsibility for the contamination, in exchange for a payment of $4 million and commitments to eliminate the use of PCBs and reduce their discharge into the Hudson.[28] The agreement provided:

> 1. With no admission of liability, GE agreed to pay $3 million to the NYSDEC and spend $1 million on research "as its full share of a comprehensive program of at least $7 million to deal with PCBs in the Hudson River and related environmental concerns." GE's $3 million contribution was to be used to monitor the presence and levels of PCBs in the river water and biota. In addition, the funds were to be used to investigate the need for remedial action and implement remedial action, if necessary.
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24. Hudson Voice, *supra* note 6.

25. GEN. ELEC. CO., COMMENTS OF GENERAL ELECTRIC COMPANY ON THE FEASIBILITY STUDY AND PROPOSED PLAN FOR THE HUDSON RIVER PCBS SUPERFUND SITE 6 (2001), *available at* http://www.hudsonvoice.com/auxiliary/technical_reports/ge_public_comment_to_EPA.pdf (last visited May 16, 2002).

26. *Id.*

27. *Id.* at 7.

28. *Id.* at 8.

> 2. NYSDEC agreed to use its "best efforts to obtain additional funds, from other sources other than GE" if the settlement funds were inadequate for implementation of remedial action, including applications to the federal government.
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> 3. GE agreed to reduce its PCB discharges in accordance with an agreed upon schedule.
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> 4. GE's acceptance of the agreement was to be in full and complete satisfaction and release of each and every claim, demand, remedy, or action whatsoever against General Electric . . . which was or might have been alleged or encompassed within the original or amended complaint in this proceeding, or which the Department may have, relating to or arising from General Electric's direct or indirect discharges of PCB's reaching the water of the Hudson River from General Electric's premises in Hudson Falls and Fort Edward, New York, including future discharges permitted by this agreement or the order for which this agreement provides.[29]

In 1977, the NYSDEC began investigating the Upper Hudson River's chemical and physical conditions using extensive samplings of sediment and water analyses of PCBs in fish.[30] Forty "hot spots" were targeted for dredging, in addition to the excavation of sites that had dredge spoils after the removal of the Fort Edward Dam that would cost $40 million.[31] However, efforts failed when a coalition of local citizens, known as Washington County CEASE, Inc., opposed the Industrial Hazardous Waste Siting Board ("Siting Board") certificate authorizing the siting of a landfill for the dredged material.[32]

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29. *Id.* at 7–8 (citation omitted).

30. *Id.* at 8.

31. *Id.* at 8–9.

32. *Id.* at 9. The coalition brought suit against the Siting Board arguing that the decision was unlawful because it violated the Fort Edward zoning ordinance. *Id.* (citation omitted). The court upheld the coalitions argument. *Id.*

In 1984, the NYSDEC tried again to develop a suitable dredging proposal for contaminated sediments from 20 "hot spots" and to locate the facility at a site in Fort Edward.[33] The Siting Board approved the project but abandoned the proposal because of its proximity to the Fort Edward population.[34] The NYSDEC Commissioner stated that:

> the project as proposed at Site G is not the one which would mitigate adverse environmental impacts to the maximum extent practical taking into account social, economic and other considerations and accordingly cannot be approved.[35]

General Electric relied heavily on the Record of Decision by the EPA in 1984, which adopted a three part remedy: 1) no action for the contaminated sediments in the Upper Hudson River; 2) capping of the remnant deposits; and 3) evaluation of the drinking water supply of Waterford, New York, which received its water directly from the Hudson.[36] The EPA decided on a "No-Action" alternative remedy since "bank-to-bank" dredging could be environmentally devastating to the river's ecosystem.[37] The EPA also echoed the decision of the NYSDEC not to dredge, which would also require a landfill site in the vicinity of the dredging.[38] Since the reliability and effectiveness of dredging technologies at the time were still uncertain, and the natural processes of the river were reducing the migration of contaminated sediments effectively, the EPA declined to seek remedial action.[39]

Since the EPA's 1984 "No-Action" decision, GE has taken a number of steps to clean the Hudson River of PCB's at its Hudson Falls and Fort Edward plants.[40] Its abatement plan calls for capturing

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33. *Id.*
34. *Id.*
35. *Id.* at 10.
36. *Id.*
37. *Id.*
38. *Id.* at 11.
39. *Id.*
40. *See generally* Hudson Voice, Using Technology to Clean the River, *at* http://www.hudsonvoice.com/programs/using_technology.html (last visited May 16, 2002).

on-shore PCB's before they reach the river and affect aquatic life.[41] General Electric has removed 139 tons of PCBs from its plants, and converted an abandoned mill to a PCB recovery system, and networked 262 wells to monitor and capture PCBs in the bedrock.[42] Polychlorinated biphenyls were also detected deep in the bedrock, beneath where drinking wells are usually found, prompting GE to contact private owners and install public water systems free of charge.[43] According to GE, as a result of its major PCB abatement program, PCB levels in Upper Hudson River fish have fallen 90% since 1977.[44]

C. *Regulatory Framework*

Amidst public outcry over toxic pollution, the ninety-sixth Congress passed the CERCLA, which was eventually amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA").[45] CERCLA granted the EPA broad authority to protect public health and the environment by cleaning up hazardous waste sites from contamination by toxic substances and assessing liability on companies that pollute.[46] The EPA Administrator's authority includes issuing regulations for hazardous substances that may present a "substantial danger" to human health or the environment.[47] The law's "strict, joint and several, and retroactive liability regime" mandated that responsible parties pay for the cleanup of the

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41. *Id.*

42. *Id.*

43. *Id.*

44. Hudson Voice, PCB levels Down 90% (citing a 2000 EPA revised baseline modeling report, *available at* http://programs/pcb_levelsdown.html (last visited May 16, 2002).

45. 42 U.S.C. §§ 9601–9675 (1994).

46. MARK REISCH & DAVID MICHAEL BEARDEN, SUPERFUND FACT BOOK (1997) (prepared for 105th Congress by the National Institute for the Environment), *available at* http://cnie.org/NLE/CRSreports/Waste/waste-1.cfm (last visited May 16, 2002).

47. *Id.* Section 102 allows for any substance which is referred to as hazardous or toxic by the EPA to be included for the purposes of CERCLA pursuant to sections 311(b)(2)(a) or 307(a) of the Clean Water Act or section 7 of the Toxic Substances Control Act. *Id.* Excluded substances include natural gas and petroleum. *Id.*

hazardous site.[48] CERCLA also provides that polluters pay for lost or damaged natural resources in addition to liability for clean up costs.[49] This broad governmental authority also permitted the establishment of a trust fund known as the Hazardous Substance Trust Fund ("Superfund") which has raised about $1.5 billion annually through taxes on petroleum and chemical industries, as well as through a corporate environmental tax providing cleanup when no financially viable party is found.[50]

For sites that warranted further evaluation, CERCLA required the National Oil and Hazardous Substances Contingency Plan ("NCP") to incorporate a National Priorities List ("NPL") for sites that pose the most serious threat to the environment and human health.[51] Superfund authorized two kinds of responses, short-term removals and long-term remedial actions. Short-term removal actions address emergency responses, while long-term remedial actions provide solutions for dangers associated with the release of such hazardous substances that most seriously threaten public health and the environment.[52] The President has the authority to provide short-term removal, or long-term remedial actions consistent with the NCP.[53]

There are various ways in which a site can be listed on the NPL. One is to evaluate the possible threat posed by the hazardous site using the Hazard Ranking System ("HRS") under which any site that scores above a certain number is eligible.[54] A state may also designate a specific site as its highest priority irrespective of its HRS rating.[55] Finally, a site may be eligible for the NPL if the Agency for

48. *Id.* at 22.

49. *Id.*

50. *Id.* at 23. However, the trust fund may run dry in the future because Congress has been unwilling to provide more money except as part of a reform package of CERCLA. The special corporate environmental tax and taxes on the petroleum and chemical feedstock industry expired in 1995. Since 1995 the Superfund has been operating on the interest from existing funds and cleanup costs paid to the EPA by private parties.

51. National Priorities List, 40 C.F.R. § 300 (1984).

52. EPA, Region 2 Superfund, *at* http://www.epa.gov/region02/superfund/ (last visited May 16, 2002).

53. *Id.* at 25.

54. *Id.*

55. *Id.* at 35.

Toxic Substances and Disease Registry issues a health advisory, if the EPA determines that a significant threat is posed to human health and the environment, or if the EPA believes that short term removal will not be as efficient as a long-term remedial action.[56] The Hudson River Superfund site proposed in 1983 was officially listed on the NPL list in 1984.[57]

The EPA must consider certain criteria when evaluating the various Superfund remedial alternatives set forth in CERCLA by conducting a detailed analysis of the possible alternatives pursuant to the NCP.[58] Nine evaluation criteria are considered in the detailed analysis prepared pursuant to the NCP.[59] The nine criteria are: 1) overall protection of human health and the environment; 2) compliance with Applicable or Relevant and Appropriate Requirements ("ARARs"); 3) long-term effectiveness and permanence; 4) reduction of toxicity; 5) mobility or volume of contaminants through treatment; 6) short-term effectiveness; 7) implementability; 8) cost; and 9) state and community acceptance.[60]

D. *Liability*

The concept of liability under section 107 of CERCLA is part of what has made it an innovative and controversial law. The federal government has numerous avenues through which to assess liability and recover costs against potentially responsible parties. The Attorney General may seek injunctive relief where the public health or environment is in immediate or substantial danger from hazardous substances, while the President may direct responsible parties to take protective action by issuing administrative orders.[61] Owners and operators of treatment, storage or disposal facilities, including generators and transporters of hazardous substances are liable for: a) all costs of removal or remedial action incurred by the federal or state government; b) any other necessary response costs incurred by any other person; and c) damages to natural resources resulting from

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56. *Id.*
57. National Priorities List, 40 C.F.R. § 300 (1984).
58. 42 U.S.C. § 9621 (1994).
59. HUDSON RIVER PCBS, *supra* note8, at 18.
60. *Id.* at 29.
61. *See generally* 42 U.S.C. §§ 9622–9623 (1994).

the release of hazardous substances.[62] Courts have been willing to imply that under section 107, there is strict liability.[63]

A discussion of liability and its consequences is important, especially in the Hudson River situation, because not only did GE have the proper permits at all times, but its actions occurred prior to the enactment of CERCLA.[64] However, it seems that Congress and courts were well aware that the liability consequences were needed to stem the tide of chemical contamination throughout the country, which at the time was endangering many of our nation's natural resources.[65] Senator Randolph remarked "this legislation addresses one of the great problems of our time: The poisoning of our land and water."[66] Senator Randolph continued on the subject of CERCLA explaining:

> The problem of hazardous waste disposal in this Nation has reached frightening proportions. While new toxic chemicals and new hazardous waste disposal facilities will be controlled and regulate under existing law, there is no procedure for dealing with dangers posed by chemicals already in the marketplace and the haphazard handling of toxic materials and past disposal of chemical wastes. The increasing incidents of contaminated drinking water, surface water, and ground water; the destruction of fish and wildlife; and the threats to public

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62. *Id.*

63. United States v. Monsanto Co., 858 F.2d 160, 168 & n.14 (4th Cir. 1988). At one point under CERCLA even landowners who did not know of the contamination when acquiring the property were also liable. *Id.* However, Congress responded to this seemingly inequitable remedy by including in SARA a defense for "innocent landowners." *Id.*

64. *See generally id.* Assuming that GE is liable for cleanup and environmental damage under CERCLA, which seems clearly true as a matter of law one might question the wisdom or fairness of CERCLA liability in light of the fact that GE had permits, assumingly was not negligent and its liability stems from a retroactive provision within CERCLA.

65. *See generally* 125 CONG. REC. S14962–63 (daily ed. Nov. 24, 1980) (statements of Sen. Randolf).

66. *Id.* at S14962.

> safety from health hazards, explosions, and fires have all made this bill necessary.[67]

By allowing CERCLA to apply retroactively, the EPA was given more than just a tool for deterrence. Rather, it was empowered to effectively combat the growing environmental problems that occurred prior to CERCLA becoming law.[68]

The courts seem to have relied heavily on legislative intent in deciding the applicability of the law.[69] Senator Randolph on the Senate floor remarked that the purpose of the bill was to "make those who release hazardous substances strictly liable for cleanup costs, mitigation, and third party damages. Thus it is assured that the costs of chemical poison releases are borne by those responsible for the releases."[70] Senator Randolph continued by stating that "strict liability [has been] . . . compromise[ed], . . . reference to joint and several liability [has been deleted], . . . [and] common law principles [must be relied on to] determine when parties should be severally liable."[71] More important are the implications of leaving joint and several liability to common law as discussed by Senator Randolph: "[t]he rule of common law is that compliance with a permit is not a defense to liability. Moreover, the Congress has never said or suggested that a federal permit amounts to a license to create threats to public health or the environment with legal immunity."[72]

One of the leading cases enforcing strict and retroactive liability is *United States v. Northeastern Pharmaceutical & Chemical Company*.[73] The defendants in *Northeastern Pharmaceutical* were held liable for the illegal dumping of 55-gallon drums of hazardous waste on a farm not suitable such dumping.[74] The court held that CERCLA is "merely a standard 'effective date' provision that indicates the date when an action can first be brought and when the time begins to run for issuing regulations and doing other acts

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67. *Id.*

68. *Id.*

69. *See generally* United States v. N.E. Pharm. & Chem. Co., 810 F.2d 726 (8th Cir.1986).

70. 125 CONG. REC. S14964 (1980) (statement of Sen. Randolph).

71. *Id.*

72. *Id.*

73. 810 F.2d at 726.

74. *Id.*

mandated by the statute."[75] The court in extending CERCLA's coverage to pre-1980 acts also referred to legislative intent by analyzing the specific liability provisions of CERCLA. As the court stated, "although CERCLA does not expressly provide for retroactivity, it is manifestly clear that Congress intended CERCLA to have retroactive intent. The language used in the key liability provisions refers to actions and conditions in the past tense."[76]

Another case which enforced CERCLA's liability scheme is *United States v. Monsanto Company*, in which all defendants were held jointly and severally liable for hazardous waste response costs for disposing of more than 7,000 fifty-five gallon drums of chemical waste causing explosions, fires and noxious fumes.[77] The court stated "the plain language of section 107(a) clearly defines the scope of intended liability under the statue and the elements of proof necessary to establish it. [The court] agree[d] with the overwhelming body of precedent that [] interpreted section 107(a) as establishing a strict liability scheme."[78] The court also justified retroactive liability because "CERCLA's legislative history and the past tense language of section 107(a) evince congressional intent to apply CERCLA retroactively."[79] "[D]ue process is satisfied simply by showing that the retroactive application is itself justified by a rational legislative purpose."[80]

II. COST-BENEFIT METHODOLOGY

The classic article *Tragedy of The Commons* and the Coase Theorem are important analyses that have had an influential impact on scholarship in law and economics, which evaluates and implements certain cost-benefit approaches.[81] *The Tragedy of The Commons* poses an interesting problem in which a pasture is open to

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75. *Id.* at 732 (citations omitted).

76. *Id.* at 732–33.

77. United States v. Monsanto Co., 858 F.2d 160 (4th Cir. 1988).

78. *Id.* at 167.

79. *Id.* at 174.

80. *Id.* (citations omitted).

81. *See generally* ROBERT COOTER & THOMAS ULEN, LAW AND ECONOMICS (3rd ed. 2000).

everyone for grazing his or her cattle. As the number of cattle exceeds the capacity of the land, each herder still benefits from adding one more animal. Although the private marginal benefit for one more animal is positive, the social costs are borne by all other herders, which in the end brings ruin to all.[82] As a result, an externality is created in which a social or monetary consequence of one's economic activity causes another to benefit without payment or suffering without compensation.[83] This theory can be applied to the Hudson River situation. The Hudson River is a common resource in that no one person or entity owns the river, nor can any one person or entity prohibit anybody else from using it, leading to non-excludability. In the end, marginal private benefits to GE (as a cheap place to dump toxic waste) are outweighed by the marginal social benefits to the rest of the public, which are large and negative because no person can utilize the resource.[84] As a result, the market may not strike a proper balance between economic output and environmental quality largely because pollution costs are borne primarily by others, rather than the polluter.

In the end, a polluter's conduct is not economically efficient because total social wealth is not maximized when others subsidize the polluter and the cost of his environmental activities.[85] External benefits can also be conferred by economic activity, even when they are not reflected in the producer's balance sheet.[86] Public goods similar to external benefits are commodities that cannot be efficiently supplied to a specific person without benefiting others. This leads to underproduction by the market even when value exceeds production costs.[87]

Economists believe that in certain situations, the problem of externalities can be solved merely by the operation of competitive markets.[88] For example, if dumping is inefficient, then its total

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82. *See generally* MANAGING THE COMMONS (John Bader & Douglas S. Noonan eds., 1998).

83. *Id.*

84. COOTER & ULEN, *supra* note 81, at 16–34

85. *See generally id.*

86. *Id.* For example, property values may rise when a deteriorated building is torn down.

87. *Id.*

88. *Id.* at 81–91.

harms will be greater than its total benefits.[89] In a competitive market people who are affected by the dumping will get together and "bribe" the dumper into stopping its release of toxic waste. This occurs because the harm realized by the people who unwittingly receive toxic waste is greater than the benefit to dumpers. According to the Coase Theorem, in a world with little or no transaction costs (imperfect knowledge, negotiation expenses, limited rationality), private bargaining will produce an efficient outcome regardless of how entitlements are allocated.[90] Thus, by terminating dumping, a surplus is realized. Theoretically, without these restrictions to bargaining, individuals will bargain to the same level of public goods or externalities regardless of the legal rule.[91] Since, the Coase Theorem involves pollution, realistically, a large number of victims of pollution, similar to the Hudson River Superfund site, would make the theorem and its zero transactions costs a near impossibility.[92] However, in situations involving a small number of victims as in a nuisance case, the Theorem could be relevant and extremely helpful.[93]

Economists view a competitive market as a way of allocating scarce resources in an efficient manner to maximize the total value of production.[94] If prices fully reflect the costs and benefits of production then the market functions correctly. In view of the fact that the problems of "externalities" and "public goods" tend to distort the market place, the government might need to intervene when the free market's failure to provide adequate incentives

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89. *Id.* at 150–74.

90. *See* R. H. Coase, *The Problem of Social Cost*, 3 J. LAW & ECON. 15–16 (1960).

91. *Id.*

92. *See generally id.* Since the Superfund Site has already incurred numerous transaction costs, the Coase Theorem is inapplicable. *See infra* Part III (discussing Superfund transaction costs).

93. Coase, *supra* note 90, at 15–16. For example, GE and the EPA as well as various environmental groups have already incurred costs from advertisements, litigation, reports and studies, which have already exceeded the zero transaction costs of the Coase Theorem. *Id.*

94. *See generally* COOTER & ULEN, *supra* note 81.

increases external costs.[95] The government may avoid market failure by providing for recognition of property rights, subsidies by the government, direct regulation, or charges for activities generating external costs. However, each of these remedies has its own problem. Thus, the choice of which remedy to employ to balance the market while keeping external costs in line can be difficult.[96]

Two options for reducing PCB's exist: dredging or bioremediation, or taking no action at all. A cost-benefit analysis can be extremely valuable for evaluating proposed sediment management strategies by combining risk and cost information to determine the most efficient allocation of resources.[97] A cost-benefit analysis weighs the cost of a proposed decision, holding, or project against the expected advantages, economic or otherwise.[98] The basic principle is that actions should be pursued as long as the overall benefit to society exceeds the social cost.[99]

However, there can be serious problems in the measurement and monetization of the benefits and costs.[100] The analysis could be used to help identify whether benefits outweigh the costs in finding the optimal solution, or which costs outweigh the benefits that might suggest that no remedial action be taken on a certain project.[101] When applying the cost-benefit measurement, the usefulness of public sector actions should be determined in dollar terms. However, the common problem is that most public actions do not have well-established private markets from which to derive accurate price information for judging their values or benefits.[102] This results in an indirect valuation of costs and benefits to which public benefits of proposed actions are compared to the alternative for public action. These alternatives may produce the largest net gain, such as an

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95. *Id.*

96. *Id.*

97. JOHN L. MOORE, COST BENEFIT ANALYSIS: ISSUES IN ITS USE IN REGULATION (1995) (prepared for 104th Congress by the National Institute for the Environment), *available at* http://www.cnie.org/NLE/CRSreports/Risk/rsk-4.cfm (last visited May 16, 2002).

98. BLACK'S LAW DICTIONARY 350 (7th ed. 1999).

99. *See* MOORE, *supra* note 97, at 11–12.

100. *Id.*

101. *Id.* at 5.

102. *Id.*

estimated surplus of monetary benefits over estimated costs, rather than in terms of private sector profit.[103]

Costs are normally easier to estimate than benefits.[104] In particular, the Upper Hudson River superfund site has costs more easily identifiable because they are a product of regulatory compliance that involve actions that are measurable in conventional monetary terms.[105] Cost estimation poses several problems including:

> 1) Difficulty in predicting technical innovations that may reduce long-term compliance costs, which can lead to an overstatement of costs relative to benefits;
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> . . . .
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> 2) Indirect or hidden costs caused by the regulatory process such as uncertainty, delay, or rigidity in implementation that are difficult to quantify and include in the scope of a cost-benefit analysis; and
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> . . . .
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> 3) Physical effects or 'costs' such as second order or consequential effects like other forms of pollution which are difficult or impossible to value in dollar terms.[106]

Some costs associated with public responses may be lost opportunities for an entirely different resource that includes mostly intangible values. [107]

Some benefits are also measurable in conventional monetary terms. For example, if a project increases the net revenue of agricultural output, this is a clear benefit attributable to the project.[108] More often problems occur when benefits have no market values that are readily compared with monetary costs.[109] Monetization of positive effects and comparing benefits and costs that occur at

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103. *Id.* at 9.
104. *Id.* at 10.
105. *Id.*
106. *Id.*
107. *Id.* at 11.
108. *Id.*
109. *Id.* For example, damning of a geologically and aesthetically unique natural resource could produce benefits in dollar terms including water supply, recreation, and hydroelectricity. However, the public value of enjoying and preserving a unique geographical feature is not so easily included in the cost estimate. *Id.*

different points in time add to the difficulty of measuring benefits properly.[110] These problems are compounded by scientific uncertainty, limits on resources, and lack of comprehensive data, all of which pose problems in the Upper Hudson River superfund site and affect the outcome of the cost-benefit analysis.[111]

III. COST-BENEFIT ANALYSIS OF THE PROPOSED DREDGING OF THE UPPER HUDSON RIVER

A. *Alternatives*

The EPA has identified five different alternatives for the rehabilitation of the Hudson River.[112] Each alternative reflects the construction time required to construct or implement the individual rehabilitation method. However, it does not include time for the design of a remedy, negotiations, or the time needed to obtain construction contracts.[113] The present-worth cost is calculated using a discount rate of 7% over a thirty-year time period.[114]

1. Alternative 1: No Action (no upstream Source Control)

Alternative 1 literally involves taking no action other than monitoring the PCB contamination at five-year intervals.[115] The No Action alternative consist of[116]

Capital Cost:	$0
Operation and Maintenance Cost (Present Worth):	$140,000
Present-Worth Cost:	$140,000
Construction Time:	0 years

110. *Id.*
111. *Id.*
112. *See* HUDSON RIVER PCBs, *supra* note 8, at 12–13.
113. *Id.* at 15.
114. *Id.*
115. *Id.*
116. *Id.*

No Active application of any remediation technology to any areas in the Upper Hudson River would be utilized.[117] Benefits for this alternative are non-existent. This remedy has no source control near the GE plants, and fails to include any administrative actions such as fish consumption advisories, restrictions on fishing, or monitoring, all of which are considered limited actions under the NCP.[118] Public health and the environment would not be protected by this alternative because it does not address the contamination in the sediment, the upstream source posing a risk to humans, birds, fish and mammals, nor does it reach the Preliminary Remediation Goal of 0.05 ppm in the allotted time frame.[119] Neither the EPA nor GE believes that this alternative is a viable solution to the contamination in the river.[120]

2. Alternative 2: Monitored Natural Attenuation (MNA) with Upstream Source Control

The MNA alternative reduces toxicity, mobility, and volume of the contaminated sediments through a naturally occurring attenuation process, as well as source control near the GE Hudson Falls plant.[121] There are various processes that can be used for the removal of PCB's through natural attenuation: "biodegradation, biotransformation, bioturbation, adsorption, resuspension, diffusion, chemical reaction or destruction, downstream transport and more."[122] To verify that the remediation of PCB contamination in the sediments is occurring, long-term monitoring would be employed to ensure that the remedial action objectives are being achieved.[123] The MNA would minimize long-term PCB transport down river, reduce the inventory of PCB's in sediments and be required to meet certain ARAR standards such as

> 1x10-6 ug/l (one part per quadrillion), the New York State standard for protection of wildlife, 1 x 10-3 ug/l, the

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117. *Id.*
118. *Id.*
119. *Id.*
120. *Id.*
121. *Id.* at 15.
122. *Id.*
123. *Id.* at 16.

> federal ambient water quality criterion for navigable waters, 1.2 x 10-4 ug/l, the New York State standard for protection of wildlife, 0.09 ug/l, the New York State standard for protection of human health and drinking water sources, and .05 ug/l the federal maximum contaminant level for PCBs in drinking water.[124]

This remedial alternative is similar to the one that GE proposes for the Upper Hudson River through the process of bioremediation and its present net worth is $39 million.[125]

Based on studies by the University of Wisconsin and the U.S. Geological Survey, GE contends that dredging provides no extra benefits as opposed to source control.[126] In thirty-four of the forty miles of the Superfund site, source control achieves lower risks to human health than dredging.[127] Furthermore, Alternative 2 has already achieved certain results since GE has implemented the plan for over a decade.[128] Since 1984, PCB levels in the Upper Hudson River have declined 60% and between 1991 and 1998, PCB levels have been found to drop at a rate of 7% per year, and with source control, PCB levels will decline another 50% in the next 10 years.[129] General Electric's source control clean-up has reduced the amount of PCBs from five pounds a day to three ounces a day. General Electric has also submitted to the NYSDEC a plan for an under-the-river system to capture the remaining three ounces per day escaping into the river.[130]

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124. *Id.* at 14.

125. *Id.* at 16.

126. Press Release, Hudson Voice, A Summary of GE's Comments to EPA on Its Massive Hudson River Dredging Plan (Apr. 17, 2001), *available at* http://www.hudsonvoice.com/final press.pdf (last visited May 17, 2002).

127. *Id.*

128. *See generally id.*

129. *Id.*

130. *Id.*

3. Alternative 3: CAP 3/10/Select-Capping with Removal to Accommodate CAP Followed by MNA with Upstream Source Control

This alternative caps a specific area after 1.73 million cubic yards of contaminated sediments are removed along with additional dredging in the navigation channel.[131] Capping entails the placement "of an engineered cap consisting of low permeability material on top of the PCB contaminated sediment, including a top layer of fill."[132] The low permeability material "prevents or retards the movement of contaminated pore water into the water column and minimizes exposure of benthic organisms to the PCB-contaminated sediments."[133] Alternative 3 consists of:[134]

Capital Cost:	$344,000,000
Operation and Maintenance Cost (Present Worth):	$24,000,000
Present-Worth Cost:	$370,000,000
Construction Time:	5 years

Four hundred and three acres of sediments would be remediated, and 207 acres would eventually be capped.[135] Additionally, 73,000 pounds of PCBs would be removed from 1.73 million cubic yards over a period of 5 years.[136] This alternative would take approximately 3 years to be designed, relies on source control, and reduces the toxicity, mobility, and volume of the contaminated sediments through a naturally occurring attenuation process after the completion of construction.[137]

Benefits from capping would differ from either Alternative 4 or 5. A "3/0/3 option" provides the best return on investment, measured by cost per kilogram of PCBs, and may be as much as $2,000 per

131. HUDSON RIVER PCBS, *supra* note 8, at 16.
132. *Id.*
133. *Id.*
134. *Id.*
135. *Id.*
136. *Id.*
137. HUDSON RIVER PCBS, *supra* note 8, at 16.

kilogram less expensive than the "3/10/select option."[138] According to the environmental group Clearwater, 3+/0/3+ removes almost as much PCB mass as 0/0/3, and is more cost-effective, while reducing the amount of material that must be dredged by almost 500,000 cubic yards.[139] The 3+/0/3+ alternative simply involves extending the removal operations beyond a strict perimeter defined by a 3-ppm contamination level.[140] The three-plus is a standard that will remove more PCBs, ease the navigational burden on the dredge operators, and may be more cost effective.[141] Furthermore, the NYSDEC fish data indicate:

> that fish at river mile 168 (Stillwater) have lipid burdens of PCBs that average eight times greater than those of fish at river mile 11 (near the George Washington Bridge). It follows that the EPA remediation hypotheses for time to safe consumption of fish at weekly or monthly intervals may be reduced significantly (if not directly by a factor of eight) for fish caught in the tidal estuary. Hence, where monthly fish meals may be safe 26 years post-remediation at Stillwater in the 0/0/3 scenario, thousands of subsistence anglers in the estuarine Hudson may be able to safely eat their catch weekly or better within a few years after remediation at the recommended 3+/0/3+ standard.[142]

4. Alternative 4: REM-3/10/Select-Removal Followed by MNA, with Upstream Source Control

Alternative 4 would include remediation of all sediments with an mass per unit area ("MPA") of 3 g/m2 PCBs or greater in Section 1, MPA of 10 g/m2 or greater in Section 2, and removal of select amounts in Section 3.[143] The total area selected for remediation is

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138. HUDSON RIVER SLOOP CLEARWATER, PUBLIC COMMENT ON EPA'S HUDSON RIVER PCBS SUPERFUND REASSESSMENT AND PROPOSED REMEDIATION PLAN (2001), *available at* http://www.clearwater.org/epa/public-comment/ (last visited May 17, 2002).

139. *Id.*

140. *Id.*

141. *Id.*

142. *Id.*

143. HUDSON RIVER PCBS, *supra* note 8, at 17.

493 acres with a total of 2.65 million cubic yards to be removed, containing 100,600 pounds of PCBs.[144] Alternative 4 consists of

Capital Cost:	$448,000,000
Operation and Maintenance Cost (Present Worth):	$13,000,000
Present-Worth Cost:	$460,000,000
Construction Time:	5 years[145]

This alternative also provides for a separate source removal and MNA including institutional controls such as fish advisories in areas not remediated.[146] The EPA has selected this alternative as the preferred remedy for the rehabilitation of the Upper Hudson River with targeted dredging.[147]

The EPA believes that this alternative will be the most effective in reaching the goals set forth in the NCP.[148] Under this alternative, risk is reduced through the removal of contaminated sediment allowing for fish consumption in the Lower Hudson River with a targeted standard of 0.4 mg/kg being reached in 20 years.[149] Within 32 years, the target of 0.2 per month will be reached.[150] In addition, this remedy will cost $110 million less than REM-0/0/3, and achieves more than Alternatives 1, 2, and 3.[151] According to the EPA, the preferred remedy fulfills the statutory requirements for permanent remedies to the maximum extent practicable unlike the capping alternative.[152] As a result, human and ecological risks will be substantially reduced below current unacceptable levels to a degree that will be real and measurable.[153]

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144. *Id.*
145. *Id.*
146. *Id.*
147. *Id.* at 26.
148. *Id.*
149. *Id.* at 27.
150. *Id.*
151. *Id.*
152. *Id.*
153. *Id.*

5. Alternative 5: REM-0/0/3-Removal Followed by MNA with Upstream Source Control

Alternative 5 would provide for Full Section remediation by removal Sections 1 and 2, and removal of contaminated sediments in Section 3 with an MPA of 3 g/m2 PCBs or greater.[154] Approximately 155,000 pounds of PCBs would be removed from an estimated 3.82 million cubic yards of sediment from a total area of 964 acres.[155] Alternative 5 consists of:

Capital Cost:	$556,000,000
Operation and Maintenance Cost (Present Worth):	$13,000,000
Present-Worth Cost:	$570,000,000
Construction Time:	7 years[156]

Upstream Source Control with MNA would also be included in this removal action until all remedial action objectives are completed.[157] Removal by targeted dredging is the principal component of Alternatives 4 and 5 and a major component of Alternative 3.[158] The goal is to leave no more than 1mg/kg or less in the target areas.[159] Alternative 5 encompasses all the benefits of the prior remedies, however, the EPA does not feel it is cost-effective enough to be considered.[160] As noted above, Alternative 5 costs $110 million more than the preferred remedy. However, even though it removes more sediment, the EPA does not believe the risk of resupension from removing an extra 250,000 cubic yards of sediment is justified.[161]

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154. *Id.* at 17.
155. *Id.*
156. *Id.*
157. *Id.*
158. *Id.*
159. *Id.*
160. *Id.* at 25.
161. *Id.*

B. *Uncertainty*

Uncertainty is one of the more important factors in a cost-benefit analysis and probably the most important factor in deciding how to best rehabilitate the river. Uncertainty exists in five areas: 1) the effects of PCBs on the Hudson River environment; 2) the effects of PCBs on human health; 3) the effectiveness of the proposed rehabilitation actions for the Hudson River; 4) the possibility of time delays in implementing the proposed remedy; and 5) the economic future for industries, as well as the surrounding communities affected by the pollution.[162] There are risks associated with each uncertainty, and a reduction in risks will provide the most efficient outcome.

The effects of PCBs in the environment have been a controversial topic for many years. In the EPA's Ecological Risk Assessment, the EPA indicated that there were major environmental problems associated with the contamination of PCBs in the Hudson River.[163] The report found that the bald eagle, great blue heron, mink, river otter, and belted kingfisher were all at risk from eating fish contaminated with PCBs.[164] This report also states that through the year 2018, all piscivorous birds and mammals are at considerable risk, and that fragile species such as the endangered bald eagle are at a higher risk.[165] The report concluded that birds' and mammals' survival, growth and reproduction are seriously affected by the PCB contamination.[166]

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162. *See generally* Hudson Voice, EPA 1984 No Dredge Decision (excerpts from a 1984 upper Hudson Record of Decision), *at* www.hudsonvoice.com/dredging/epa_rejected/epa_1984_no_dredge_decision.html (last visited May 17, 2002); Associated Press, *Studies Reaffirm PCBs' Hazards* (Apr. 15, 2001), *available at* http://www.poughkeepsiejournal.com/projects/pcb/co041501s1.shtml (last visited May 17, 2002).

163. *See generally* EPA, ECOLOGICAL RISK ASSESSMENT ADDENDUM: FUTURE RISKS IN THE LOWER HUDSON RIVER EXECUTIVE SUMMARY (1999), *available at* http://www.epa.gov/hudson/addendum.htm (last visited May 17, 2002).

164. *Id.* at 9.

165. *Id.* at 6, 8.

166. *Id.* at 9.

General Electric, on the other hand, contends that the Hudson River environment is stable and continues to be a haven for wildlife.[167] According to GE, the white perch population of the Lower Hudson River is relatively stable and the populations of the shortnose sturgeon and the striped bass have increased dramatically.[168] Furthermore, while the EPA concludes that the range of PCB contamination in kingfishers is 4 to 280 times the level that the EPA predicts, the kingfisher population continues to thrive in the Lower Hudson river along with the bald eagle, which have returned after a 100-year absence, along with mallard ducks, great blue herons and raccoons.[169] The Atlantic States Marine Fisheries Commission ("ASMFC") in its annual striped bass stock assessments, concluded that "from 1976 through 1997, the annual production of young stripped bass has fluctuated without trend; PCB concentrations in the spawning females these fish have declined steadily over the same period."[170] General Electric points out that the EPA:

> [r]elied exclusively on models and ignored site-specific data demonstrating that PCBs have not adversely affected ecological resources of the Lower Hudson River in the past, and will not do so in the future. The models used by the EPA to predict future concentrations of PCBs in water, sediment, and fish tissue contain many deficiencies and have been inadequately reviewed to date.[171]

Human health concerns are also a point of dissension between the EPA and GE. The EPA classifies PCBs as probable human carcinogens that may also cause non-cancer health effects such as learning problems, low birth weight, hormone changes, hyperactivity

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167. *See generally* GEN. ELEC. CO., COMMENTS OF GENERAL ELECTRIC COMPANY ON HUDSON RIVER PCBS REASSESSMENT RI/FS PHASE 2 BASELINE ECOLOGICAL RISK ASSESSMENT FOR FUTURE RISKS IN THE LOWER HUDSON RIVER (2000).

168. *Id.* at 42. The upward trend of striped bass is particularly important because the EPA has concluded that the risk to these species is very high.

169. *Id.* at 26–36.

170. *Id.* at 23.

171. *Id.* at 37.

and reduced immunity to fight infections.[172] A study conducted on people who had eaten PCB contaminated fish in Lake Michigan found intelligence scores were lower in the children whose mothers had the highest PCB levels in their blood.[173] The Human Health Risk Assessment for the Upper Hudson River found a cancer risk and non-cancer hazard from the consumption of fish, while the same report for the Mid-Hudson River presented a cancer risk and non-cancer hazard above the EPA's level of concern under Superfund.[174] According to the EPA, people who eat fish from the Upper Hudson River once a week face the risk of one additional case of cancer for every 1,000 people, which is unacceptable under Superfund's tolerated risk of 1 in 10,000.[175]

General Electric relies heavily on the largest human study, which found no link between PCB exposure and cancer mortality.[176] The study focused on 7,075 men and women who worked between 1946 and 1977 in two factories that used PCBs in the manufacturing of electrical capacitors.[177] The study compared the 1,195 people who died in the study to the regional and national averages of mortality, with an average follow-up time of 31 years.[178] While the average American has four to eight parts per billion ("ppb") in their blood, some workers in the study tested at levels as high as several thousand ppb.[179] However, the study showed that the death rate of workers in the two factories for all cancers was at or significantly below the expected level. While 699 and 420 deaths were expected among the male and female workers, only 586 and 380, respectively, were actually observed.[180]

Uncertainty also exists over the effectiveness of the proposed rehabilitation actions to be taken by the EPA, as well as the time

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172. Hudson Voice, Latest News [hereinafter Latest News], *at* http://www.hudsonvoice.com/auxiliary/latest_news/latest_ddt.html (on file with the *Fordham Environmental Law Journal*).

173. *Id.*

174. *See generally* HUDSON RIVER PCBS, *supra* note 8.

175. *Id.*

176. Latest News, *supra* note 172.

177. *Id.*

178. *Id.*

179. *Id.*

180. *Id.*

needed to implement the proposed remedy. As noted above, the EPA's preferred remedy is the REM 3/10/Select, which will cost $460,000,000 and take 5 years to implement.[181] The EPA evaluated the alternative against the first seven criteria of the NCP and has found it to be protective of human health and the environment, as well as the most reliable in reducing the risk from the consumption of fish in sections 1, 2, and 3 and the Lower Hudson River.[182] Within 20 years of active remediation, the target concentration of 0.4 mg/kg for an average adult who consumes one fish meal every two months will be attained in sections 1 and 2.[183] In section 2 the target of 0.2 mg/kg for an average adult who consumes one fish meal in two months will be attained within 32 years, while the target concentration of .05 mg/kg in the Upper Hudson River (section 3) will be attained within 43 years.[184] The EPA believes its proposal will significantly reduce PCBs and bring them to acceptable federal and state levels.[185] However, of the last ten environmental dredging projects that have been completed to date, they have only achieved an average of 2.2 to 5.9 ppm, even though these were smaller and more accessible projects.[186]

The EPA is proposing an environmental project of unprecedented size and complexity, which could cause delays in the estimated time to implement and complete the dredging of the Upper Hudson River. It took six years to dredge 179,000 cubic yards of PCB contaminated sediment by hydraulic auger dredge at Manistique River and Harbor in Michigan, with a target of only 10 ppm PCBs for the residual sediments.[187] In fact after three years of dredging the average level of PCBs actually increased, while in the fourth year, there were levels as high as 829 ppm in the sediment.[188] At the Saginaw River

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181. HUDSON RIVER PCBS, *supra* note 8, at 26.

182. *Id.* at 27.

183. *Id.*

184. *Id.*

185. Hudson Voice, Three Case Summaries: A Review of Three Sites Where Dredging Failed to Achieve the Low Levels of PCBs Required by Regulators, *at* http://www.hudsonvoice.com/ dredging/ dredging_fails_elsewhere/dredging_case_summaries.html (last visited May 17, 2002).

186. *Id.*

187. *Id.*

188. *Id.*

in Michigan, 205,000 cubic yards of PCB-contaminated sediment were removed by mechanical crane-operated bucket, working 24 hours a day for 35 weeks.[189] This produced 981 cubic yards per day, only half of what the EPA expects to achieve in the Hudson River.[190] According to GE, the best rate the EPA could hope to achieve dredging the Upper Hudson River is about 50 to 75 cubic yards per hour—three to five times lower than the rate in the Feasibility study.[191] A 2001 National Academy of Sciences ("NAS") report indicated that dredging technology had not materially improved over the last decade and that dredging does not achieve target concentrations in surface sediments.[192] In fact the report concluded that "dredging will remobilize and redistribute buried contaminants, potentially increasing risks; this resuspension can not be fully controlled."[193] The NAS also made it clear that the EPA may not be able to control the risks, concluding that "[b]ecause at least short-term exposure and risk is related to surficial sediment concentrations within the biologically active zone, mass removal itself might not achieve risk-management goals."[194]

General Electric's proposed rehabilitation program is similar to Alternative 2.[195] The proposed remedy will reduce or eliminate the release of PCBs to the Hudson River by installing a tunnel/drain system to expand the hydraulic capture zone beneath the Hudson River.[196] Fifteen hundred more pounds of PCB contaminated sediment is lost to the Lower Hudson River in the sixty-seven years leading up to 2068 using the dredging alternative than if the EPA chose Source Control.[197] Source control is expected to speed up the time when anglers may be able to eat their catch by 10 years in

189. *Id.*

190. *Id.*

191. *Id.*

192. COMMENTS OF GENERAL ELECTRIC FEASIBILITY STUDY AND PROPOSED PLAN FOR HUDSON RIVER PCBS, *supra* note 25, at 182.

193. *Id.*

194. *Id.*

195. *See generally* GEN. ELEC. CO., *supra* note 25; HUDSON RIVER PCBS, *supra* note 8, at 15.

196. *See generally* GEN. ELEC. CO., *supra* note 25; HUDSON RIVER PCBS, *supra* note 8, at 15.

197. GEN. ELEC. CO., *supra* note 25; HUDSON RIVER PCBS, *supra* note 8, at 15.

section 3.[198] However in Section 1 and 2, it will delay the ability of anglers to eat their catch by 5 to 6 years, during which the dredging alternative would be the better choice.[199]

Another area of uncertainty involves the economic impacts of the surrounding community and industries affected by pollution. Various environmental groups believe the dredging project will be an economic boon for the economically depressed upstate New York towns near the project site.[200] A report commissioned by Scenic Hudson and Hudson River Sloop Clearwater stated that dredging would generate more than 3,500 jobs with a payroll of $88 million over 5 years, and that indirect activities such as consumer spending would add an additional $53 million in Washington and Saratoga counties.[201] The overall impact on the regional economy according to Knowledge, Logic, Information, Organizational, Strategy Inc. ("KLIOS") consist of:[202]

	Direct Impact	Indirect Impact	Total Impact
New Jobs	3,543	1,028	4,571
New Payroll	$88.5 million	$52.5 million	$141 million
Gross Regional Product			$800 million

Long-term benefits might even reach a total of 8,900 new jobs with a maximum payroll of $346 million, which would affect the entire twelve county Hudson River Valley from an expected rise in economic activity associated with water transportation and waterfront development.[203] However, this calculation has been challenged in an article in the Schenectady Gazette, which concluded: "[a]t $25,000 per job, that pays for 709 jobs, not 3,543. At union scale, the number of jobs is more like 300 to 400. Thus

198. GEN. ELEC. CO., *supra* note 25; HUDSON RIVER PCBS, *supra* note 8, at 15.

199. GEN. ELEC. CO., *supra* note 25; HUDSON RIVER PCBS, *supra* note 8, at 15.

200. Gordon Boyd, *Economic Advantages of Dredging Exaggerated*, SCHENECTADY GAZETTE, Aug. 26, 2001, at F1.

201. KLIOS, INC., HUDSON RIVER REGIONAL ECONOMIC IMPACT ANALYSIS: IMPACT OF ENVIRONMENTAL REMEDIATION 4 (2001).

202. *Id.*

203. *Id.* at 5.

each worker on the dredging project after five years would have had five jobs, not one. And 709 workers would have had just about 3,543 jobs."[204]

The economic impacts and potential benefits were also calculated by the report drafted by KLIOS Inc.[205] In 1976, when the commercial striped bass fishing industry was closed to the Hudson River it was estimated to be worth $40 million annually while the sport fishing industry enjoyed $20 million annually before the health advisories were imposed.[206] If these fishing industries were reestablished, the potential impact could be 274 to 300 direct jobs, and $8 to $9 million annually in direct wages.[207] The report concludes that "[t]he economic benefits accruing from recreational fishing activity are not limited to individuals from privately owned boats, but also include charter and party boat activity, as well as land-based support services . . . direct and indirect benefits accruing from recreational fishing total upwards of several million dollars."[208]

C. *Discounting*

Discounting is applied to costs incurred and benefits received in the future for several reasons.[209] One reason is that generally, people would rather receive benefits sooner and pay incurred costs later.[210] Another reason for discounting is that money received today could be invested to earn a return on the investment. Money available today is worth more to people than money that is received in the future.[211] Discounting reverses this process. If $1 is invested at a 10% interest rate, it will be worth $1.10 after a year, $1.21 after two years, by calculating the value, in today's dollars, of a given amount

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204. Boyd, *supra* note 200, at F4.

205. *See generally* KLIOS, INC., *supra* note 201.

206. *Id.* at 6.

207. *Id.*

208. *Id.* at 21.

209. Ecosystem Valuation, Applying Ecosystem Value Estimates Benefit Cost Analysis, *at* http://www.ecosystem valuation.org/1-04.htm (last visited May 17, 2002).

210. *Id.*

211. *Id.*

to be received in the future.[212] For the Hudson River dredging project, if Alternative 4 is implemented the $460,000,000 price tag is discounted over thirty years at a 7% discount rate. This reflects the discount of the money used over the thirty-year period which in today's dollars is worth more if it was invested rather than being expended in thirty years.[213] The problem is that one who receives $1.10 at the end of the year at a 10% discount rate, would have been equally happy with a $1.00 today. In a situation where hundreds of millions of dollars are being spent, it is entirely possible to show a loss at the end of the thirty years from the money that could have been invested but has now been discounted and is worth less than was originally allocated.[214]

When calculating social costs, a social discount rate is used to reflect society's preferences for allocating natural resource use over time.[215] Determining the social discount rate can be a problem since it is extremely difficult to quantify social costs so that a social discount rate accurately reflects society's preferences.[216] The discount rate used can have an immense effect on the results of a cost-benefit analysis with larger discount rates giving more weight to the present in relation to the future.[217] Smaller discount rates for environmental protections that are lower than the market rate would leave more opportunities to future generations.[218]

IV. FUTURE COSTS

Future costs are extremely important for the cost-benefit analysis of the Upper Hudson River dredging project, since any of the proposed rehabilitation alternatives will more than likely have environmental drawbacks when implementing the selected alternative. Unfortunately, this translates into more costs for the proposed remedy. CERCLA requires that future costs such as

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212. *Id.*
213. MOORE, *supra* note 97, at 5.
214. Ecosystem Valuation, *supra* note 209.
215. *Id.*
216. *Id.*
217. *Id.*
218. *Id.*

adverse impacts from dredging (increased land and water traffic, increased air and noise pollution, and risks to workers and the surrounding community) be factored into the feasibility of the proposed remedy.[219] The EPA, when revising the NCP, determined that short-term effectiveness is critical to the decision process stating:

> When the alternatives provide similar long-term effectiveness and permanence and reduction of toxicity, mobility or volume, the other balancing criteria rise to distinguish the alternative and play a more significant role in selecting the remedy. For example, if two alternatives offer similar degrees of long-term effectiveness and permanence, and reduction of toxicity, mobility or volume through treatment, but one alternative would require more time to complete and would have greater short-term impacts on human health and the environment, the decision maker would focus on the distinctions between the alternatives under the short-term effectiveness criterion.[220]

The proposed alternative would include long-term construction operations that would "contribute intrusive, repetitive, jarring noise for 24 hours a day, 6 days a week, and 30 weeks a year each year for the duration of the project."[221] Additional noise pollution would be created by dredges, excavators, barge traffic and tugboats, as well as by the sediment processing operations from barges unloading and the operation of trucks, rail and other heavy machinery.[222] This noise would occur mainly in spring and summer, when local residents open their windows and spend time outside.[223]

The adverse effect of air pollution from dredging is another cost that must be considered when making a decision on a remedy. The operation of dredges will release contaminants into the ambient air

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219. WASH. COUNTY CEASE, INC., COMMENTS OF WASHINGTON COUNTY CEASE INC. ON THE DECEMBER 2000 USEPA FEASIBILITY STUDY FOR THE HUDSON RIVER SUPERFUND SITE (2000), available at http://www.nodredging.org/cease1.pdf (last visited May 17, 2002).

220. *Id.* at 14.

221. GEN. ELEC. CO., *supra* note 25, at 100.

222. WASH. COUNTY CEASE, INC., *supra* note 219, at 54.

223. *Id.*

through the combustion of diesel and other fuels as well as aerosols from the lifting and dropping of dust and liquids.[224] Odors will be created from releases of "ammonia and toxic hydrogen sulfide through air contact with decomposing organic matter in the sediments after removal."[225] Air pollution would also increase because of the traffic and processing facilities located near the dredging site.[226]

The proposed plan will also place significant stress on the existing transportation infrastructure. Barge transportation will be required for the dredging operations, construction, and other associated activities.[227] Other vessels would be seriously impeded by the addition of barges, which would have to pass through the canal system occupying 20 to 30 minutes per lock, with about 10 trips per day.[228]

Safety issues would be a concern, since there will be increased freight traffic on a single rail line operated characterized by a number of at-grade crossings with no active safety crossing devices.[229] In order to ensure safe use of the existing rail line, both Amtrak and Canadian Pacific adhere to strict safety measures, which could be compromised by additional freight traffic.[230] Increased truck traffic will increase safety hazards on local roads and provide for the increased potential of spilled contaminated materials.[231] An influx of heavy trucks needed for the dredging will be a considerable burden on the existing railways, which are generally two lane roads in rural areas.[232]

The EPA's reassessment plan takes into account all of these potential problems. The EPA realizes that transfer facilities and treatment areas present potential problems to the community under the active alternatives.[233] Access to all construction sites and

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224. *See generally* GEN. ELEC. CO., *supra* note 25.
225. *Id.*
226. *Id.*
227. WASH. COUNTY CEASE, INC., *supra* note 219, at 41.
228. GEN. ELEC. CO., *supra* note 25, at 105.
229. *Id.* at 103.
230. *Id.*
231. *Id.* at 64.
232. *Id.*
233. HUDSON RIVER PCBS, *supra* note 8, at 23.

treatment areas will be restricted to authorized personal only.[234] Monitoring and engineering controls will be utilized to minimize short-term effects due to material processing activities.[235] While the potential for traffic accidents may increase due to additional vehicles on local roads, the EPA believes these adverse effects will be minimal since most transportation will be by rail.[236] Since there will be additional river and vehicular traffic, work areas in the river will be isolated with a sufficient buffer zone so that recreational and commercial traffic will be able to safely avoid these areas.[237] The EPA also plans to control river traffic to minimize adverse effects of the dredging on recreational and commercial traffic by sequencing and directed dredging to ensure the navigational channel is not obstructed due to the construction.[238]

CONCLUSION

A true cost-benefit analysis of the Upper Hudson River Superfund site, with all benefits quantified, would prove that the remedy selected by the EPA to remove PCB's has significantly more costs than benefits. Taking into consideration all the available information, the amount of uncertainties in this analysis seems to demand that these issues be addressed before dredging begins. By balancing the costs and benefits and taking into account factors such as uncertainties and discounting, a cost-benefit methodology provides a different way in which to decide whether dredging should be the proper remedy. However, this methodology suffers from severe limitations, which unfortunately prevent a true cost-benefit analysis from being employed due to inadequate data and the numerous amounts of uncertainties present. Without reliable data on the effects of PCBs on the Hudson River environment, the effectiveness of the proposed rehabilitation actions for the Hudson River and the economic future of effected industries, it is difficult to apply a cost-benefit analysis to the proposed EPA remediation plan.

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234. *Id.*
235. *Id.*
236. *Id.*
237. *Id.*
238. *Id.*

The cost-benefit methodology has painted a picture in which some aspects of the cost-benefit analysis indicate where control is desirable and more importantly, the importance of pollution control. Aspects such as the human health concerns and the effectiveness of the selected alternative must be clearly resolved so as to be able to effectively make a decision for selecting a cost effective remedy. Nevertheless, it is important to realize that while not every aspect can be truly quantified, it is in the best interest of the public to understand that economic ramifications and ethical problems apply to decisions that are made.