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What Comes Out Must Go In: Cooling Water Intakes and the Clean Water Act

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I. INTRODUCTION

Every day, thermal electric generating facilities in the United States draw in more than 200 billion gallons of fresh, coastal, and ocean waters for cooling.[1] Along with this water, these power plants suck in and destroy enormous numbers of fish and other aquatic organisms. For example, at the P.H. Robinson electric plant in Texas, over 7 million fish were killed by being drawn into the plant's intake screens[2] in a one-year period.[3] During a ten-week period in 1970, 1.3 million fish were killed on the intake screens of the Indian Point plant on New York's Hudson River.[4] At the Millstone plant in Connecticut, impingement on the intake screens killed more than 2 million fish during late summer and early fall of 1971.[5]

For organisms that make it through the screens and into the plant's cooling system, death tolls are also dramatic. The Environmental Protection Agency ("EPA") estimates that between 7 million and 164.5 million menhaden were killed each day by being drawn into the plant during the summer of 1971 at the Brayton Point plant in Massachusetts.[6] For sixteen days in 1972,

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1. EDISON ELEC. INST., ENVIRONMENTAL DIRECTORY OF U.S. POWER PLANTS at 1-1 to 1-345 (1991) [hereinafter 1991 ENVIRONMENTAL DIRECTORY]. This quantity is greater than the daily flow of the Ohio River. *See* STATISTICAL ABSTRACT OF THE U.S. 206 (1991).

2. *See infra* note 13 (describing "impingement").

3. JOHN CLARK & WILLARD N. BROWNELL, ELECTRIC POWER PLANTS IN THE COASTAL ZONE: ENVIRONMENTAL ISSUES (Am. Littoral Soc'y Special Publication No.7, 1973) V-8 tbl. V-B.

4. *Id.*

5. *Id.*

6. *Id.* at V-14 tbl. V-C.

an estimated total of 36 million fish were killed in this fashion at the Millstone plant.[7]

Despite these harms, power plants need water to cool the steam condensers that are part of their electric generating systems. Electric generating plants use one of two cooling processes. The once-through cooling system is the most common way to cool the condensers.[8] This system draws water into the plant and passes it through the condenser systems to cool them. In this process, the cooling water absorbs heat from the condensers. Then, the once-through cooling system discharges the warmed water back into the environment.

The second most common system, closed-cycle cooling,[9] uses only a single supply of water. This water is passed through the condenser systems to cool them, as in the once-through system. But then this warmed water is subjected to a process that cools the water with air so it can be reused.[10] Because this single supply of water is recycled, closed-cycle cooling systems need to draw in only enough new water to make up for evaporative or other losses, and they discharge similarly small quantities of heated water into the environment. As a result, a closed-cycle system withdraws only two to four percent of the quantity of water used by a comparable once-through system.[11]

Both the water intake and discharge processes of once-through cooling cause environmental damage. The intake process causes two distinct types of harm. First, it pulls or "entrains" small organisms into the cooling system, sending them on a nor-

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7. *Id.*

8. *Id.* at V-15. As reported by Edison Electric Institute, plants providing 44% of the country's installed steam-electric generating capacity use once-through cooling. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 15 fig. 4.

9. *See id.* at V-15. Plants providing 35% of the country's installed steam-electric generating capacity use closed-cycle cooling. The remaining plants that are neither once-through or closed-cycle provide 21% of the country's generating capacity and use cooling systems that consist of hybrid forms of once-through and closed-cycle processes. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 15 fig. 4.

10. This process of cooling the cooling water in a "closed cycle" can include sending the water through large, natural draft, hyperbolic towers or through large mechanical draft arrays, or spraying the cooling water into the air in cooling ponds. Combinations and variations of both cooling and intake systems exist. For example, a spray cooling pond can be used to reduce the final effluent temperature of once-through cooling waters. *See* DAVID M. GATES, ENERGY AND ECOLOGY 265–70 (1985).

11. *See* CLARK & BROWNWELL, *supra* note 3, at III-5.

mally fatal roller coaster ride through the plant.[12] Second, as water is drawn in, larger organisms may not be entrained with the smaller organisms but are often caught or "impinged" on screens at the intake structure's mouth.[13] These screens are designed to prevent larger objects from damaging the fragile tubes of the condenser systems. The intake of anything other than water is detrimental to both the power plant and the organisms.[14]

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12. The EPA has described entrainment and entrainment effects as follows:

> [E]ntrainment . . . is the taking in of organisms with the cooling water. The organisms involved are generally of small size, dependent on the screen mesh size, and include phyto- and zooplankton, fish eggs and larvae, shellfish larvae, and many other forms of aquatic life. As these entrained organisms pass through the plant they are subjected to numerous sources of damage. These include mechanical damage due to physically contacting internal surfaces of pumps, pipes and condensers; pressure damage due to passage through pumps; shear damage due to complex water flows; thermal damage due to elevated temperatures in condenser passage; and toxicity damage caused by the addition of biocides to prevent condenser fouling and other corrosives. Those organisms which survive plant passage potentially could experience delayed mortality when returned to the receiving water.

U.S. Envt'l Protection Agency, Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b), P.L. 92-500, at 1 (1977) [hereinafter Guidance Manual] (unpublished draft) (on file with the *Harvard Environmental Law Review*).

13. EPA described impingement and impingement effects as:

> the blocking of larger entrained organisms that enter the cooling water intake by some type of physical barrier. Most electric generating plants have screening equipment (usually 3/8" mesh) installed in the cooling water flow to protect downstream equipment such as pumps and condensers from damage or clogging. Larger organisms, such as fish which enter the system and cannot pass through the screens, are trapped ahead of them. Eventually, if a fish cannot escape or is not removed, it will tire and become impinged on the screens. If impingement continues for a long time period the fish may suffocate because the water current prevents gill covers from opening. If the fish is impinged for a short period and removed, it may survive; however, it may lose its protective slime and/or scales through contact with screen surfaces or from the high pressure water jets designed to remove debris from the screens. Delayed mortality to many species of fish following impingement may approach 100 percent. For some species of fish, the intake represents a double jeopardy situation where the same population will be subject to increased mortality through entrainment of eggs and larvae and additional mortality to juveniles and adults through impingement.

Id.

14. The clogging of condenser tubes has a direct effect on thermal generating capacity

At the other end of the cooling system, the release of warmed water—"thermal discharge"—also causes environmental damage. Thermal discharges may affect vegetation that comprises essential aquatic habitat[15] or may alter the oxygen-carrying capacity of the water.[16] In addition, the warm discharge waters and the plentiful food supply provided by organisms killed or stunned during entrainment may encourage overcrowding of fish in the relatively small areas around power plant discharge sites.[17] Elevated water temperatures can lead to abnormally high concentrations of nitrogen which can, in turn, lead to embolism kills.[18] When a power plant shuts down rapidly, massive fish kills have occurred as a result of cold shock.[19] Despite a recent trend to use the more environmentally benign closed-cycle systems in new generating

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and operating efficiency. A report by Electric Power Research Institute noted the following ways in which debris and biogrowth can harm the plant's condenser system:

> *Debris and biogrowth trapped inside condenser tubes can cause high local water velocities, which can promote tube erosion-corrosion through enhancement by differential aeration.
> *Debris and biogrowth blockage of tubes results in a reduction of heat transfer rate which, in turn, causes increased condenser backpressure and unit heat rate.
> *Clogging of the tube sheet [the large plate where water enters the condenser tubes] eventually leads to excessive head losses [pressure differentials] in the system, which will result in reduced cooling water flow, higher condenser temperature rise, and, consequently, increased unit heat rate and condenser backpressure.
> *Attachment and growth of fouling organisms on intake conduits can increase frictional resistance and reduce open area of the intake lines . . . .
> *Decomposition of trapped organic debris can generate compounds which cause stress cracking and sulfide pitting of copper alloy tubes during outages . . . .
>
> Plant performance losses from increased condenser backpressure can significantly affect the cost of meeting consumer demand for power. These costs result from the need to consume greater quantities of fuel at the particular power plant or to generate the needed electrical energy elsewhere.

ELECTRIC POWER RESEARCH INST., EPRI No. CS-3550, CONDENSER MACROFOULING CONTROL TECHNOLOGIES 3 (1984).

15. CLARK & BROWNELL, *supra* note 3, at VI-4 to VI-5.
16. *Id.* at VI-2.
17. *Id.* at V-12.
18. *Id.* at VI-18 to VI-20.
19. *Id.* at VI-14 to VI-18.

plants, the once-through plants in operation still have decades of useful life remaining[20] during which millions of fish will be killed.[21]

Congress, aware of the environmental hazards associated with cooling water intakes, provided for their regulation in the Clean Water Act ("CWA").[22] Specifically, section 316 of the Clean Water Act[23] addresses both the intake and discharge aspects of water withdrawals for cooling, and establishes standards for the EPA or the states, through delegated programs, to apply.[24]

The Clean Water Act was the product, to a certain extent, of the states' failure to individually address the politically difficult problem of environmental degradation of their waters.[25] Despite the statute's enactment, neither the states nor EPA have made significant efforts to solve the problem of cooling water intakes. This failure resulted from the coincidence of two key constraints. First, the dominant role of federal authority in water pollution control programs under the CWA stifles, or at least fails to reward, state initiative.[26] Second, although this Article argues that EPA has a mandatory duty to issue regulations for cooling water intakes under Section 316(b) of the CWA,[27] neither Congress nor any environmental group has forced EPA to carry out this mandate.

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20. Fossil fueled power plants generally have "design" lives ranging from 30 to 40 years. Jill S. Baylor, *Acid Rain Impacts on Utility Plans for Plant Life Extension*, PUB. UTIL. FORT., Mar. 1, 1990, at 22, 22. Various modifications can significantly extend the lives of these plants. *Id.* Nuclear power plants are generally said to have 40-year lives, based upon their license period, although some operators are seeking 20-year life extensions. *See* Richard R. Zuercher, *Niagara Mohawk May Ask Extension of 20 Years for Nine Mile Point-1*, NUCLEONICS WK., Oct. 31, 1991, at 2, 2. Some seventy percent of plants using once-through cooling systems were brought into service since 1960. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 1-1 to 1-345.

21. Although organisms killed by cooling water intakes include all manner of small aquatic life, this Article uses the term "fish" to denote all such organisms.

22. 33 U.S.C. §§ 1251–1387 (1988).

23. *Id.* § 1326.

24. Section 316(b) of the Clean Water Act, 33 U.S.C. § 1326(b), applies to any point source—a "discernable, confined and discrete conveyance", *id.* § 1362(14)—regulated under the Clean Water Act. *See* United States Steel v. Train, 556 F.2d 822, 849–50 (7th Cir. 1977). The largest use of water for cooling is at electric power plants. *See supra* note 1 and accompanying text.

25. *See* S. REP. No. 414, 92d Cong., 2d Sess. (1972), *reprinted in* 1972 U.S.C.C.A.N. 3668.

26. Under the Act, EPA must establish guidelines for water quality standards, CWA § 301, 33 U.S.C. § 1311, effluent guidelines, *id.* § 1304, and effluent limitations and standards, *id.* § 1316. Water quality standards and Pollution Discharge Elimination System programs established by the states are subject to EPA approval and oversight, *id.* §§ 1313, 1342(b).

27. *Id.* § 1326(b).

Consequently, the states do not have the benefit of clarifying regulations promulgated by EPA.

A number of factors explain the lack of enthusiasm for federal regulations governing cooling water intakes. First, although of critical import to aquatic ecosystems,[28] the small fish and planktonic life that the regulations would protect are of relatively little concern to many people.[29] Second, the regulations would be an additional burden on the already highly regulated electric industry and would raise the cost of electricity. The electric industry provides a product virtually every citizen desires and needs. In their individual service territories, many electric utilities still function as regulated monopolies despite recent trends toward increasing competitiveness in the generation, transmission, and distribution of electricity.[30] Consequently, the electric generating industry, which such regulations would affect, is one of the most dynamic and powerful in America. It is not surprising, then, that little enthusiasm has developed for cooling water intake regulations that would place potentially costly controls on this powerful industry.

Third, attempts to regulate cooling water intakes would confront at least four of the many complexities typically associated with technology-based standards.[31] First, the relationship between the cost and the effectiveness of specified environmental protection technologies implicates difficult economic issues. Regulatory imposition of added fish protection requirements for intake systems would be reflected in higher electric rates. Therefore, selecting appropriate regulatory standards necessarily involves a difficult balancing of these costs against the benefits of fish protection. Second, the science used to determine environmental impacts de-

28. Fish and fisheries are important for commercial, economic, and recreational, as well as ecological, reasons. *See* Magnuson Fishery Conservation and Management Act, 16 U.S.C § 1801 (1988) (containing congressional statement of findings, purpose, and policy).

29. As one researcher stated, "There is very little known about fish, how they survive and the effects on the ecosystems. Environmentalists don't want to touch the idea of fish conservation. People giggle if you talk about saving fish." *Fishing and Pollution Imperil Coastal Fish, Researchers Find*, N.Y. TIMES, July 16, 1991, at C4 (statement of Anne Kinsinger, National Fish and Wildlife Foundation).

30. *See generally* U.S. CONGRESSIONAL OFFICE OF TECHNOLOGY ASSESSMENT, OTA-E-409, ELECTRIC POWER WHEELING AND DEALING: TECHNOLOGICAL CONSIDERATIONS FOR INCREASING COMPETITION chs. 1–2 (1989).

31. This Article uses "technology-based standards" to refer to regulations requiring the adoption of specific technologies to address environmental problems. A requirement that power plants use closed-cycle cooling systems, as opposed to a once-through process, would be a technology-based standard.

pends on complex models and extrapolative techniques.[32] These, in turn, depend on complete and accurate data, which are lacking for cooling water intakes.[33] Third, technological solutions require the integration of complex scientific disciplines including, but not limited to, fluid dynamics, construction engineering, biological survey and assessment, and electrical engineering.[34] Finally, any statutory or regulatory ambiguity in the technology-based standards leads to an emphasis on litigation over environmental protection.[35]

These obstacles to technology-based regulation are not, however, insurmountable. First, the pervasive regulation of utilities simplfies determinations of whether plant improvements are economically achievable. This should enable decisionmakers to include environmental costs in their calculations about optimal cooling water intake structures.[36] Second, EPA developed a regulatory approach soon after the enactment of the CWA that proved the viability of developing site-specific standards and requirements.[37] And third, early intensive litigation[38] prompted the development of a capable body of science in both the biological and engineering fields.

However, the regulatory program that EPA developed after the enactment of the CWA crumbled in 1976 when the courts remanded EPA's regulations for their failure to properly incorporate required informal guidelines into the formal regulatory program.[39] Yet rather than simply correcting the defect and promulgating new cooling water intake regulations, EPA abandoned its regulatory efforts. As a result, environmental hazards associated with cooling water intakes have remained substantially unregulated

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32. *See generally* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS: A CASE STUDY IN ENVIRONMENTAL IMPACT ASSESSMENT (Lawrence W. Barnthouse et al. eds., Am. Fisheries Soc'y Monograph No. 4, 1988) [hereinafter, SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS].

33. *See infra* text accompanying notes 69–76.

34. *See generally* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32.

35. *See* Thomas B. Yost, *Science in the Courtroom, in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 294 (describing difficulty of legal and administrative resolution of scientific issues).

36. *See* ENERGY INFO. ADMIN., ELECTRIC PLANT COST AND POWER PRODUCTION EXPENSES 1989, at 39–51, 55–72 (1989). *See generally* EDWARD KAHN, ELECTRIC UTILITY PLANNING AND REGULATION (1991).

37. *See infra* Part III.B.1.

38. *See infra* Part III.B.2 and cases cited therein.

39. *See infra* notes 195–202 and accompanying text.

since 1979. The states have mirrored the EPA's inaction.[40] Thus, although data are generally unavailable to support a definitive conclusion, there is every reason to believe that, in the absence of regulation, impingement and entrainment losses associated with cooling water intake structures have continued and may have become even more significant.[41] In sum, the EPA has failed to provide the states with leadership, and the states have failed to act without this guidance.[42]

Recent events suggest a need to revisit the regulation of cooling water intakes. Once-through cooling systems, designed and constructed in a social, political, and economic atmosphere that placed little or no value on environmental impacts, are poorly suited to contemporary conditions. Nationwide droughts in the late 1980s adversely affected utility services when cooling water supplies fell.[43] The recent appearance of the zebra mussel in the Great Lakes and other water bodies may force electric utilities to choose between the retrofit installation of closed-cycle systems and the use of highly toxic biocides to prevent clogging of fragile condensers.[44] Recent studies have found that fishery populations

40. *See infra* Part III.E.

41. There are at least four reasons to believe these losses are growing. First, demand for electric power increases constantly. Second, the economics of power plant operation favor life-extensions of existing plants. *See supra* note 20. Third, fishery populations face increasing pressure from humans. *See infra* text accompanying note 45. Fourth, even as pollution control efforts under the CWA improve overall water quality, impingement and entrainment effects could inhibit fish population recovery by preying on embryo, larvae and juveniles before they have a chance to contribute to population recovery. *See infra* notes 77–78 and accompanying text.

42. *See infra* Part III.E.

43. *See* Gary Baker, *Drought, Heat Force Five Plants to Derate, Put Others on Alert*, NUCLEONICS WK., July 21, 1988, at 1, 1; Anne MacLachlan, *French Nuclear Plants Suffer from Drought*, NUCLEONICS WK., Aug. 24, 1989, at 4, 4; *Shallow Rivers Again Hurt Utility Operations in Central, Southeast*, ELEC. UTIL. WK., Dec. 26, 1988, at 7, 7; *Utilities Pay Higher Costs, Adjust Operations in Confronting Drought*, ELEC. UTIL. WK., July 18, 1988, at 7, 7. Other natural events create problems for electric generating plants using once-through cooling. *See, e.g.*, *Fish Overwhelmed Power Plant Cooling System*, UPI, Jan. 13, 1990, *available in* LEXIS, Nexis Library, UPI File (reporting that freeze killed tilapia fish, clogging intakes and forcing shutdown); *Jellyfish*, UPI, Aug. 31, 1984, *available in* LEXIS, Nexis Library, UPI File (reporting that jellyfish clogged intakes and forced shutdown at loss of $1.2 million per day); *Millstone 3 Startup Delayed Again*, UPI, Nov. 1, 1988, *available in* LEXIS, Nexis Library, UPI File (reporting that storm-driven seaweed blocked intake screens); Gary Rosenberger, *New York Rocked by Storms, High Winds, Earthquake*, UPI, Oct. 19, 1990, *available in* LEXIS, Nexis Library, UPI File (reporting that storm over Lake Ontario stirred up weeds and vegetation, clogging intakes and forcing plant shutdown); *Unusual Event Declared as Precaution at Oyster Creek*, PR Newswire, Jan. 3, 1990, *available in* LEXIS, Nexis Library, PR File (reporting that sustained winds impeded tidal flows into canal, causing low water intake levels at nuclear plant).

44. *See The Problem of Zebra Mussel Infestation, 1990: Hearings on S. 811 Before*

once presumed to be nearly infinite are fully exploited or have fallen to critically low levels.[45] Several states are forcing the electric generation industry to account for externalized environmental costs,[46] suggesting the need for current information on environmental losses associated with cooling water intake structures.[47] In some circumstances, the basis of risk assessment is being expanded to include not only human-centered concerns but also ecological values.[48] Additionally, those states that have taken on the responsibility for regulating cooling water intake effects face costly battles with utility companies over permit conditions.[49] For these reasons, and with the reauthorization of the Clean Water Act pending, it is time to measure progress under section 316 of the Clear Water Act, the one section of the Act that focuses not on discharges, but on intakes.[50]

Part II of this Article discusses the environmental hazards in more detail and explains how cooling water intakes produce them. Part III of this Article examines the history of regulation and nonregulation under section 316(b) of the Clean Water Act, describes the development of the "common law" concerning the

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the Subcomm. on Water Resources, Transportation, and Infrastructure of the Senate Comm. on Environment and Public Works, 101st Cong., 2d Sess. (1990); *see also* William Claiborne, *Mollusks Overwhelm Great Lakes*, WASH. POST, Aug. 12, 1991, at A12; Phil Mintz, *Tiny Zebra Mussels Pose a Giant Threat*, NEWSDAY, May 28, 1991, at 53; *New Waterway Threat*, N.Y. TIMES, Nov. 26, 1991, at C2 (reporting new, hardier species of zebra mussel).

45. *See, e.g.*, NATIONAL FISH & WILDLIFE FOUND., FY 1992 WILDLIFE AND FISHERIES ASSESSMENT: NATIONAL MARINE FISHERIES SERVICE App. B (1991).

46. *See Key Externalities Economist Defends "Damage Cost" Approach*, ELECTRIC POWER ALERT, Sep. 4, 1991, at T-10, T-10.

47. *See* PACE CTR. ENVTL. LEGAL STUDIES, ENVIRONMENTAL COSTS OF ELECTRICITY Ch.V.F. (1990) [hereinafter PACE REPORT] (describing attempt to monetize externality costs of impingement and entrainment at power plants using once-through cooling systems).

48. *See* EPA SCIENCE ADVISORY BD. REDUCING RISK: SETTING PRIORITIES AND STRATEGIES FOR ENVIRONMENTAL PROTECTION 9, 17, 25 (1990) [hereinafter REDUCING RISK]; *see also* EPA SCIENCE ADVISORY BD., THE REPORT OF THE ECOLOGY AND WELFARE SUBCOMMITTEE: RELATIVE RISK REDUCTION PROJECT 16–32, 68–70 (1990), *reprinted in* REDUCING RISK, *supra*, App. A.

49. For a discussion concerning such costly permit battles on the Public Service Electric & Gas Co.'s Salem plant in New Jersey, see *PSE&G Says Salem Station Not Affecting Aquatic Life in Delaware River*, PR Newswire, Nov. 8, 1990, *available in* LEXIS, Nexis Library, PR Newswire File. For a similar discussion regarding the San Onofre Plant in California, see *San Onofre—Cooling System Is the Threat*, L.A. TIMES, Dec. 10, 1989, at Q5 (reporting an evaluation of mitigation measures for plant under consideration by California Coastal Commission).

50. At the time of this writing, one proposed bill of amendments to the CWA would delete the current, albeit ignored, requirements of § 316(b) and replace them with the single word "Reserved." *See* S. 1081, 102d Cong., 1st Sess. § 8(d)(1) (1991).

cheaper, and the modest maintenance of those systems is virtually free.[55]

As an intake system draws in cooling water, it must screen or filter "foreign matter" from the flow intended for the condenser tubes. Of course, it cannot filter every organism from the flow. Thus, this filtering causes two varieties of damage, both of which inevitably result from the intake process.[56]These are entrainment[57] when the filtering fails, and impingement,[58] when it succeeds.

Cooling water intakes entrain small planktonic organisms. The resulting loss of these organisms can threaten the important base of aquatic food chains, ultimately causing the death of fish and other larger organisms.[59] Entrainment at a single plant easily can kill billions of planktonic organisms each year.

In addition, entrainment causes enormous direct loss of fish. As of 1973, the highest calculated daily kill had occurred at the Brayton Point Plant in Massachusetts on July 2, 1971, when 164.5 million menhaden died.[60] On other days that summer, kills ranged from 7 million to 28 million per day.[61] Such losses are not limited to these individual incidents. At some plants, as many as fifty percent of entrainable fish in the adjacent water body are drawn

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55. *See* ENERGY INFO. ADMIN., *supra* note 36, at 39–51, 55–72 (1989) (tabulating data from 50 fossil fired and 71 nuclear powered steam-electric power plants). No fossil-fired plant reported expenses for coolant or water. *Id.* For the nuclear plants, coolant and water expenses for 1989 ranged from nothing to approximately $11 million. *Id.* Yet there are, in fact, other costs in addition to the costs mentioned above. Permit requirements accompanying withdrawal and discharge of water for cooling water systems represent a cost attributable to using the water. The loss of alternative uses of the cooling water also can be considered a cost. Most importantly, however, the true social cost of using the water for cooling must include the environmental degradation that accompanies that use. For an assessment of the environmental costs attributed to fish kills at thermal electric power plants, see PACE REPORT, *supra* note 47, ch. V.F.

56. The net environmental impact associated with a cooling water intake system varies with water volume, discharge constraints, water velocity, specific characteristics of the screening system such as mesh size, rate of screen cleaning, presence of debris or plant life, water body morphology, season, fish population densities, proximity of intakes to discharge points, depth of intakes, orientation of intakes, and the competing effects of other power plants or other mortality inducers. *See generally* EPA, DEVELOPMENT DOCUMENT FOR BEST TECHNOLOGY AVAILABLE FOR THE LOCATION, DESIGN, CONSTRUCTION AND CAPACITY OF COOLING WATER INTAKE STRUCTURES FOR MINIMIZING ADVERSE ENVIRONMENTAL IMPACT (1976) [hereinafter DEVELOPMENT DOCUMENT]; CLARK & BROWNELL, *supra* note 3.

57. *See supra* note 12.

58. *See supra* note 13.

59. *See* CLARK & BROWNELL, *supra* note 3, at V-18 to V-24.

60. *Id.* at V-11.

61. *Id.*

into power plant cooling systems.[62] Yet in spite of entrainment's great potential for environmental damage, available governmental data is sparse, allowing for only rough estimation of losses.[63]

Impingement mortalities are also large. It has been estimated that fish kills for the more than ninety thermal electric generating stations on the shores of the Great Lakes exceeded 40 million fish per year prior to 1973.[64] A 1979 estimate puts the annual loss figure at approximately 100 million fish—a number equal to fifteen percent of the United States and Canadian annual harvest for all species in the Great Lakes.[65] Studies on impingement at the Indian Point, Lovett, and Bowline facilities in New York found that the total impingement mortality of just four species—white perch, striped bass, Atlantic tomcod, and American shad—was roughly 5.5 million in 1974 and 3 million in 1975.[66] The water intakes at the San Onofre Nuclear Generating Station in California reportedly kill some fifty-seven tons of fish each year and reduce the population of some species by as much as seventy percent.[67] One researcher reported that:

> [t]he annual cooling water demand of the Salem nuclear generating plant in New Jersey accounts for an estimated 11% direct reduction in the Delaware estuary year-classes of weakfish *Cynoscion regalis* and a 31% direct reduction of the bay anchovy *Anchoa mitchilli.* In the Hudson estuary during summer periods of high electric power demands, the water diversions of the several Hudson River generating plants often exceed the fresh water input to the river. Impingement croppings alone reduce the annual year-class abundances of Hudson River white perch *Morone americana* by 20% or more, and the year-

62. *Id.* at V-15 to V-16 (reporting kills at Surry Plant in Virginia, Millstone plant in Connecticut, and Indian Point plant in New York). *See infra* notes 3–7 (discussing these kills in more detail).

63. In a study of 91 power plants located on the Atlantic coast, the author was only able to obtain impingement data for 20 plants and entrainment data for 12 plants. *See* Karl R. Rábago, What Comes Out Must Go In: The Regulation and Effects of Cooling Water Intakes at Thermal Electric Generating Facilities 4 (May 26, 1990) (unpublished report of Atlantic Coast Power Plant Project for The Hudson Riverkeeper Fund, Garrison, N.Y.) (on file with the *Harvard Environmental Law Review*).

64. CLARK & BROWNELL, *supra* note 3, at V-18 to V-24.

65. GATES, *supra* note 10, at 273–74.

66. Lawrence W. Barnthouse & Webster Van Winkle, *Analysis of Impingement Impacts on Hudson River Fish Populations*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 182, 184.

67. *Coastal Commission Orders Utility to Restore Damaged Wetlands, Kelp Beds*, 22 Env't Rep. (BNA) 802, 802 (July 26, 1991).

> class losses of striped bass *Morone saxatilis* to entrainments and impingements are 10 to 15%. The long term consequences of these annual reductions remain unknown . . . . In many cases, nonetheless, the effects of continued water withdrawals are believed to pose serious threats to the perpetuation of indigenous species . . . .[68]

As with entrainment losses, however, the information on impingement losses is largely anecdotal.[69] Reliable and comprehensive data for aggregate national losses are unavailable.

Because precise, current, national losses caused by impingement and entrainment at electric power plants are unknown, the long-term benefits of cutting these losses cannot be accurately predicted. The previous availability of some such information was the beneficial result of research prompted by administrative and judicial scrutiny during the short life of cooling water intake regulation.[70] The last nation-wide attempt to quantify these losses, undertaken at Argonne National Laboratories in 1977,[71] ended abruptly with the demise of EPA's regulatory program under section 316(b) of the Clean Water Act.[72] Crude estimates based on a wide variety of studies and reports suggest that an "average" nuclear plant with a generating capacity of 500 megawatts kills approximately 1.6 million fish by impingement, and 2.6 billion fish by entrainment each year.[73] An "average" fossil fuel-burning electric generating plant kills some 600,000 fish through impingement, and 1.7 billion fish through entrainment each year.[74] With nearly 258,000 megawatts of installed capacity in the United States using once-through cooling systems,[75] total annual impingement and entrainment losses are certain to be extremely high.[76]

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68. R. Ian Fletcher, *Flow Dynamics and Fish Recovery Experiments: Water Intake Systems*, 119 TRANSACTIONS AM. FISHERIES SOC'Y 393, 394 (1990) (citations omitted).

69. *See supra* note 63 and accompanying text.

70. *See generally* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32.

71. ARGONNE NAT'L LAB., NO. ANL/ES-56, SURVEY OF FISH IMPINGEMENT AT POWER PLANTS IN THE UNITED STATES (1977). The survey produced three volumes, one on the Great Lakes, one on inland waters, and one on estuaries and coastal waters. The study's fourth volume, to be entitled "Data Collection and Analysis," was never published.

72. In 1979, EPA formally withdrew its regulations under § 316(b), *see* 44 Fed. Reg. 32,956 (1979), following judicial invalidation and remand of those regulations. *See infra* notes 195–202 and accompanying text.

73. *See* Rábago, *supra* note 63, tbl. 3.

74. *Id.*

75. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 1.

76. It would unreasonably strain the credibility of the collected data to attempt to

Besides the numbers of organisms killed directly, there are conditional mortality rates[77] associated with intake structures. Although fish and other aquatic organisms lay hundreds, even thousands, of eggs,[78] relatively few adults ultimately develop. Thus, the extent to which the intake effects "compete" with already high natural losses for the few fish that would mature even without human induced additional losses is crucial.

B. Intake Structures

The problems of impingement and entrainment result from a complex interrelationship of physical principles relating to the drawing of water through screening devices. Despite a number of variations, cooling water intake structures generally possess some common features.

Water screening is essential to the protection of condenser systems. Failure to adequately protect these relatively fragile systems from clogging may result in poor performance or even system shutdown.[79] In the United States, two common screening devices are employed.[80] First, an array of bars spaced two and a half to three inches apart is placed across the mouth of the intake struc-

use it to determine more than a rough estimate of national losses. The collected data spanned a number of years, were not evaluated for consistency of collection or analysis, and were not always independently reviewed. The author developed these estimates by reviewing publicly available reports of impingement and entrainment at power plants. Because of the paucity of data, the "average" that resulted reflects single year/single plant estimates drawn from a wide range of years and sources. At any rate, it is ultimately not the actual losses that are most significant, but their relationship to the probability of survival within relevant populations of fish.

77. The conditional mortality rate is the incremental mortality (or incremental fractional reduction in the survival of year-class members) caused by entrainment or impingement or both. Natural mortality must be taken into account in the calculation of a conditional mortality. Over the course of a life, impingement or entrainment mortalities "compete" with natural mortality for the survivors. *See* Barnthouse & Van Winkle, *supra* note 66, at 184; *see also* C. Phillip Goodyear, *Assessing the Impact of Power Plant Mortality on the Compensatory Reserve of Fish Populations*, *in* PROCEEDINGS OF THE CONFERENCE ON ASSESSING THE EFFECTS OF POWER-PLANT-INDUCED MORTALITY ON FISH POPULATIONS (1977), *reprinted in Reauthorization of the Anadromous Fish Conservation Act, 1979: Hearings on S. 838 Before the Subcomm. on Resource Protection of the Senate Comm. on Environment and Public Works*, 96th Cong., 1st Sess. 127–36 (1979).

78. *See, e.g.*, C. Phillip Goodyear, *Implications of Power Plant Morality for Management of the Hudson River Striped Bass Fishery*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 245, 249 tbl. 78 (reflecting life history data used in impact simulations).

79. *See supra* note 14.

80. Richards, *supra* note 53, at 578.

ture to prevent the entry of large debris. A bar raking device is usually added to clean this large debris. Second, behind the first array, a fine screen with three-eighths-inch mesh filters out smaller objects and organisms.[81] Because suspending a screen in front of the water flow creates cleaning difficulties, these screens are configured on a rotating belt system, which continuously cleans the upper portion of the screen while the lower portion remains positioned in the flow.[82] A typical 600 megawatt fossil fuel unit requires water flows of approximately 340,000 gallons per minute and needs at least 750 square feet, or 70 square meters, of mechanically cleanable screen face.[83]

The variety of once-through intake technologies in place in the United States is rather limited.[84] The "through-flow travelling screen" most commonly used today is the same as the screen that has been used since the turn of the century.[85]

Recent events demonstrate a need for electric generating facilites to protect aquatic organisms.[86] This in turn has engendered some interest in improving screen systems.[87] Engineers have begun to examine alternative systems available in Europe and Japan, as well as alternatives to screening, such as porous dikes.[88] The following passage exemplifies the engineering perspective with respect to these choices.

> In the past decade, U.S. interest in screening technology has been at an unusually high level . . . . In their efforts to find a

81. *Id.*
82. *Id.*
83. *Id.*
84. *Id.*
85. *See* ELECTRIC POWER RESEARCH INST., *supra* note 14, at ch. 3, 10 fig. 3-13 (showing picture of screen installed in 1910).
86. Engineering, biological, and legal issues surrounding power plant intakes demonstrate the need for greater environmental protection efforts. One example that suggests the relevance of all of these issues is provided by an examination of the Hudson River power plants. *See* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32. *See also* NEW YORK UNIV. SCH. OF LAW & NATURAL RESOURCES DEFENSE COUNCIL, THE HUDSON RIVER POWER PLANT SETTLEMENT (Ross Sandler & David Schoenbrod eds., 1981) (conference materials) (on file with the *Harvard Environmental Law Review*).
87. *See, e.g.*, ELECTRIC POWER RESEARCH INST., EPRI No. CS-3644, ADVANCED INTAKE TECHNOLOGIES STUDY at v (1984); Paul W. Fournier, New Technology for Environmentally Safe, Money Saving Water Withdrawal 4 (1980) (Materials for Symposium on Surface Water Impoundments) (on file with the *Harvard Environmental Law Review*; also available from Johnson Division, Surface Water Screen Department, St. Paul, Minn.).
88. Porous dikes are essentially leaky dams. *See* ELECTRIC POWER RESEARCH INST., EPRI No. CS-2594, POROUS DIKE INTAKE EVALUATION 1-1 to 1-2 (1982).

> more environmentally acceptable way of screening water, engineers have discovered, but rarely used, screen technologies that have been overlooked by the power industry. Unfortunately, from a fish protection standpoint, most of the alternative screen types are no better than the through-flow. *However, when considering debris removal efficiency, lower operating costs, and higher reliability the alternative screens have much to offer.*[89]

The implicit suggestion is that research on and investment in less expensive screening technologies are justified regardless of their consequences for fish protection. From an environmental perspective, however, dedicating resources to such technologies defers the search for and implementation of effective fish protection technologies.

The physical factors involved in water withdrawal suggest that environmental effects can be strongly influenced by operational or design decisions. First, if thermal discharges are located near the intake bays, or if tidal effects carry discharged water past the intakes,[90] water near the intakes will be warmed. If this occurs, fish may gravitate toward the warmer water, and more of them will be drawn into the plant than would be drawn in if the water were at normal temperatures.[91] Second, if intake flow is reduced in order to mitigate some environmental dangers without reducing condenser intake speed, the intake bays would have to be enlarged. Yet larger intake bays increase the opportunity for impingement and entrainment and thus offset, to a degree, the advantages of reduced intake velocity.[92] Third, decreasing screen mesh size to reduce entrainment requires increased intake flows[93] and thus increases the potential for impingement. This is because the increased screen surface area, resulting from the smaller mesh size, requires an increase in velocity of intake flows in order to offset the added friction and to move the same volume of water into the cooling system. Finally, decreasing the difference between intake and discharge temperatures implies a reduction in the time the

89. Richards, *supra* note 53, at 581 (emphasis added).

90. This is likely to occur at shoreline plants located on estuaries. There, the twice-daily tides may carry discharge water toward the intakes.

91. *See* CLARK & BROWNELL, *supra* note 3, at V-1 to V-2.

92. *Id.* at VIII-1 to VIII-11.

93. *Id.*

cooling water is inside the plant cooling the condenser.[94] This, in turn, implies a need for increased water flow. However, increased flow volume increases impingement losses. Moreover, lower temperature differentials may increase the likelihood of biofouling inside the condenser system.[95]

The above list describes only a few of the many environment-related engineering issues involved in the design and operation of cooling water intake structures. A complete assessment of appropriate intake designs at an individual plant requires an analysis of the fish types and population characteristics in the area of the intakes, an examination of the physical characteristics of the water body, a consideration of seasonal factors, and an appraisal of cumulative impacts from nearby water withdrawals.[96] In addition, such an evaluation must consider the power plant's financial ability to modify either its systems or its operations, as well as the effects of such expenses on electricity rates and reliability of electric services.

In short, we need a systematic interdisciplinary approach to environmental impact assessment and mitigation incorporating elements of engineering, ecology, and economics.[97] To provide a basis and an impetus for such efforts, EPA must take a firm policy stance reflecting these environmental concerns.

III. The Statutory and Regulatory Scheme

Congress first became formally aware of intake effects when considering thermal pollution.[98] In the late 1960s, thermal pollution

94. *Id.*

95. *Id.*

96. *See supra* note 56.

97. An example of this sort of interdisciplinary impact evaluation approach can be found in the National Environmental Policy Act ("NEPA"), 42 U.S.C. §§ 4321–4370 (1988). In that statute, Congress commanded federal agencies to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment," *id.* at § 4332(2)(A), and to include in recommendations and proposals a "detailed statement" on environmental impact, adverse environmental effects that can be avoided, alternatives, long- and short-term goals and effects, and irreversible or irretrievable commitments of resources. *Id.* § 4332(2)(C). *See also infra* note 298 and accompanying text (discussing California's impact statement requirement for cooling water intakes).

98. *See Thermal Pollution—1968: Hearings Before the Subcomm. on Air and Water Pollution of the Senate Comm. on Public Works*, 90th Cong., 2d Sess. 136–39 (1968)

from power plants had become a significant concern for the Congress and occupied a considerable amount of hearing time.[99] At these hearings, Congress received scientific and economic evidence revealing the complexity of issues involving thermal discharge and cooling water intakes. During this period, these issues also caught the attention of the press,[100] certain segments of the public, and the scientific community.[101] As is apparent from a reading of *Scenic Hudson Preservation Conference v. Federal Power Commission*,[102] the scope of relevant considerations for power plant siting and operations expanded greatly.[103] In response to these concerns, Congress finally addressed both cooling water intakes and thermal discharges[104] in the Federal Water Pollution Control Act Amendments of 1972.[105]

A. The Statutory Scheme

Congressional efforts to establish the current Clean Water Act regime centered around two similar potential amendments to the Federal Water Pollution Control Act: Senate Bill 2770[106] and House Bill 11,896.[107] The two bills adopted similar formats, were consol-

[hereinafter *Thermal Pollution—1968*] (discussing "The Extent to Which Environmental Factors are Considered in Selecting Powerplant Sites, with Particular Emphasis on the Ecological Effects of the Discharge of Waste Heat into Rivers, Lakes, Estuaries, and Coastal Waters").

99. *Id.*

100. *See, e.g.*, 118 CONG. REC. 33,707–08 (1972), *reprinted in* SENATE COMM. ON PUB. WORKS, 93D CONG., 1ST SESS., A LEGISLATIVE HISTORY OF THE WATER POLLUTION CONTROL ACT AMENDMENTS OF 1972, at 196–97 (1973) [hereinafter LEGISLATIVE HISTORY].

101. *See, e.g.*, ROBERT H. BOYLE, THE HUDSON RIVER: A NATURAL AND UNNATURAL HISTORY 313 (1979). The chapters entitled "Power, Power Everywhere" and "Epilogue, 1969–1978" recount the public controversy over the now famous proposed Storm King Pumped Storage Reservoir and the Hudson River Power Plants. *Id.*; *see also Thermal Pollution—1968*, *supra* note 98, at 472.

102. 354 F.2d 608 (2d Cir. 1965), *cert. denied*, 384 U.S. 941 (1966).

103. The *Scenic Hudson* court held that the Federal Power Commission's responsibilities in siting decisions include "as a basic concern the preservation of the natural beauty and of national historic shrines, keeping in mind that, in our affluent society, the cost of a project is only one of the factors to be considered." *Id.* at 624–25.

104. *See* 33 U.S.C. § 1326 (1988).

105. Federal Water Pollution Control Act Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816 (codified as amended at 33 U.S.C. §§ 1251–1387 (1988)).

106. S. 2770, 92d Cong., 1st Sess. (1971), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1534.

107. H.R. 11,896, 92d Cong., 2d Sess. (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 893.

idated into the Senate Bill in conference, and were passed into law over President Nixon's veto on October 18, 1972.[108]

1. The House Bill

One approach to regulating cooling water intakes is illustrated by the House Bill. This relatively rigorous approach would have required industry to consider environmental impacts and implement mitigation measures as a prerequisite to EPA approval.[109] As will be discussed in more detail below, the House received, and apparently considered persuasive, vigorous arguments opposing uniform national standards for thermal effluents and their related cooling water intake effects.[110] Specifically, representatives of the power industry testified in hearings on the original House version of the Act that industry-wide transition to closed-cycle dry cooling towers would provide absolutely no benefits to society.[111]

These concerns were reflected in the ultimate structure of the House Bill which provided for regulation of thermal discharges in a manner suggested by the Public Works Committee.[112] This House approach was defined by its treatment of thermal discharges as a special type of pollutant, its use of a multi-factor test for choosing design alternatives and mitigation measures, and its narrow but flexible provision for variances. To provide for separate regulation of thermal discharges, the House's definition of "pollutant" included "heat" but did not include "thermal discharges in accordance with regulations issued pursuant to section 316 of the Act."[113] This process of inclusion and exclusion set the stage for

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108. *See supra* note 105.

109. *See infra* notes 116–125 and accompanying text.

110. *See infra* notes 130–135 and accompanying text.

111. *See Water Pollution Control Legislation, 1971: Hearings on H.R. 11896, H.R. 11895 Before the House Comm. on Public Works*, 92d Cong., 1st Sess. 775–76 (1971).

112. The original House version of the Federal Water Pollution Control Act Amendments of 1972 did not contain a section on thermal discharges or cooling water intakes. *Id.* The section that appeared in the House's final effort was added to the bill as an amendment in the Public Works committee by Representative Frank Clark of Pennsylvania. 118 CONG. REC. 33,765 (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 273.

113. H.R. 11,896, *supra* note 107, § 502(6), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1068 (defining "thermal discharge" as any discharge at a temperature different from the ambient temperature of the receiving waters).

the House's distinct approach to regulating temperature discharges separately from other pollutants in section 316 of the House Bill.[114]

Section 316 of H.R. 11,896 would have required EPA to develop regulations for the control of thermal discharges within one year of the statute's enactment.[115] It would have mandated that the regulations "recognize that the optimum method of control of any thermal discharge may depend upon local conditions, including the type and size of the receiving body of water,"[116] allowing for appropriate flexibility in the choice of intake technologies. The House bill would have required regulatees to complete a process not unlike an environmental impact statement under the National Environmental Policy Act.[117] The House Bill would have provided that:

> [t]he regulations shall require any person proposing to make such a discharge to consider all alternative methods for controlling such a discharge, including, but not limited to (1) utilization of available water bodies or cooling devices, including once-through cooling, mixing zones, cooling ponds, spray ponds, evaporative or non-evaporative cooling towers, (2) dilution of heated waters with cooler waters, and (3) an alternation of the outlet configuration.[118]

This range of alternatives represented the entire spectrum of cooling methods known at the time to scientists and engineers in the field.[119] By specifying these potential methods, the House Bill built intake regulation into their provision for thermal discharges. And the proposed legislation would have required that both EPA and the proposed discharger consider these fully before an intake system could be used.[120]

At one end of this technology spectrum was the once-through option, which required no improvement over existing systems.

114. H.R. 11,896, *supra* note 107, at § 316(b), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1043–45.

115. *Id.*

116. *Id.*

117. 42 U.S.C. § 4332(2); *see also supra* note 97.

118. H.R. 11,896, *supra* note 107, § 316(b), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1043–45.

119. *See* CLARK & BROWNELL, *supra* note 3, at III-1 to III-10.

120. H.R. 11,896, *supra* note 107, § 316(b), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1043–45.

But at the other end of the spectrum was the alternative of closed-cycle evaporative cooling towers, which offered optimal control of both thermal discharges and intake effects. Further, subsections (2) and (3) of the proposed provision made it clear that modifications to avoid and mitigate environmental consequences also would have to be considered in the permitting process.

In choosing among the possible technologies, EPA and the proposed discharger were to identify and evaluate all technically feasible systems and, from them, select alternatives on the basis of feasibility, net benefits, the impact on the environment, and the potential for mitigation.[121] In this selection process, EPA and the proposed discharger were to consider particularly the environmental impacts on water, land, and air, along with methods of both minimizing adverse effects and maximizing beneficial effects.[122] While the bill did not specify the priority of these factors, it did prescribe a decisionmaking process that charged EPA with the responsibility of ensuring a robust evaluative effort.[123] To further ensure that the analysis would be sufficiently comprehensive, the House's proposed section 316 would have required public notice and comment on any regulations thereunder and would have specifically directed EPA to monitor changes in technology and alternatives and to revise the regulations accordingly "from time to time."[124]

The House Bill called for a special approach to variances as well. Under the version of section 316 that was proposed by the House, regulations developed for thermal discharges need not have been strictly applied to sources when the economic and social

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121. The bill would have provided that:

> In evaluating such alternative methods of control consideration shall be given to (1) their relative engineering and technical feasibility, (2) their relative social and economic costs and benefits, (3) their relative impact on the environment, considering not only water quality but also air quality, land use, and effective utilization and conservation of natural resources, and (4) methods of minimizing adverse effects and maximizing beneficial effects of such discharges.

H.R. 11,896, *supra* note 107, at § 316(b), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1044.

122. *Id.*

123. *Id.*

124. H.R. 11,896, *supra* note 107, at § 316(c), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1044.

costs bore no reasonable relationship to the economic and social benefits.[125] Thus, in determining whether a variance was to be granted, all social costs, not only economic ones, were to be compared to all benefits.[126] In a rare case in which the costs bore no reasonable relationship to the benefits, EPA could have permitted an "appropriate adjustment" consistent with the greatest degree of control reasonably achievable.[127]

The House's approach to variances from thermal discharge regulations stands out in comparison to the method prescribed in its proposed section 301 for other types of variances. Under this latter system, a variance would be triggered merely by a regulatee's inability to attain compliance "at a reasonable cost."[128]

The House's overall approach to thermal discharges would have allowed for individualized consideration of differences and for some modification of regulatory requirements on a site-by-site basis without sacrificing maximum achievable control. This individualized approach is appropriate for thermal discharges and the related intake effects. This is because steam electric generating plants use a limited variety of cooling systems.[129] Therefore, factors such as siting and the distinctive characteristics of the surrounding ecosystem tend to determine the nature of a facility's environmental impact. Accounting for these differences in regulation is beneficial because that will help regulators tailor the controls to be adopted by individual regulatees to each facility's needs. Normally, recognition of individual site and plant differences would frustrate the category-wide technology-based standards ap-

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125. H.R. 11,896, *supra* note 107, at § 316(a), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1422–23.

126. *Id.*

127. *Id.*

128. H.R. 11,896, *supra* note 107, at § 301(b)(2)(A), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 964. The final version of § 301 also identified economics as a limiting factor applied after best technology determinations were made. Both the House and the Senate had included the multi-factored cost/benefit analysis approach in the original versions of § 306, which required standards of performance for new sources. H.R. 11,896, *supra* note 107, at § 306(c), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 993; S. 2770, *supra* note 106, at § 306(c), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1626. The version of § 306 that was enacted requires the greatest degree of effluent reduction achievable through application of best available demonstrated control technology to be the guide for new source standards, but it allows EPA to perform the multivariant analysis, and specifically directs the Administrator to take into account the cost of achieving effluent reduction and non-water quality environmental impact and energy requirements. 33 U.S.C. § 1316 (1988).

129. *See supra* notes 84–85 and accompanying text.

proach used to regulate other pollutants. For other industries, individualized regulation might be too burdensome because there are often too many individual sources or facilities to regulate. Additionally, in other industry categories, there is a much greater variety of control technologies and surrounding circumstances. Accommodating all these variations with individualized regulation could lead to regulatory paralysis. However, for cooling water intakes, relatively individualized regulations grounded in best technology standards are both practical and beneficial. Indeed, the House found two unique characteristics of thermal discharges supporting this individualized approach.[130]

First, the interest of national uniformity inherent in the choice of the effluent limitations and guidelines approach used for all other pollutants was deemed inapplicable.[131] Unlike other industries, the electric generating industry was considered unable to concentrate in "pollution havens," for the factors considered in siting decisions are population, power demand and transmission capability.[132] Second, the arguments favoring individualized regulation were particularly compelling and less fraught with risk than similar efforts in other contexts. The relatively small number of sources of major thermal discharges made site-specific regulation practicable. Further, it had been "persuasively shown during the hearings . . . that the appropriate type and level of control over thermal discharge varies substantially among different waters and regions of the country."[133]

The House provision regulating thermal discharges and, incidentally, cooling water intakes, would have created a rather ponderous special mechanism for regulation of thermal discharges. However, the author of the provision, Representative Frank Clark of Pennsylvania, explained that special regulation of thermal dis-

130. 118 CONG. REC. 33,761 (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 263 (statement of Representative Don H. Clausen).

131. *Id.*

132. In theory, permitting nonuniform regulation leaves certain geographic regions with weaker regulations than others. Potential regulatees would logically cluster in those areas to avoid compliance expenses, creating environmentally-devastated "pollution havens." The clustering of electric power plants and the environmental damage associated with them are not real dangers, however, because so few plants are necessary to serve a given region and because the plants must be situated near the communities they serve. Therefore, the argument against differential regulation is inapplicable to power plant thermal discharges. *But see infra* note 309.

133. 118 CONG. REC. 33,761 (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 263.

charges was necessary because of heat's unique characteristic as a pollutant capable of dissipation.[134] And the Committee on Public Works had concluded that regulations should be developed and that costs and benefits should be evaluated on a case-by-case basis for thermal discharges.[135]

If enacted, the House version of section 316 would have required each steam electric generating facility utilizing once-through cooling with thermal discharges to engage in a full environmental impact assessment of the ecosystem, the facility itself, and the entire range of alternative technologies, including retrofit of intake and discharge structures.[136] The analysis then would have been reduced to some formula for weighing economic and social costs, and, ultimately, to some rational decisionmaking method designed to optimize all relevant environmental and social values.

The House version of the amendments would have provided detailed guidance to both EPA and the regulated community.[137] As a component of its proposed regulation of thermal discharges, the House approach would have required the consideration of intake effects and technologies. But to some degree, the House bill failed to provide a logical starting point for such analysis: the House approach suffered from a lack of standards by which to measure performance.[138]

2. *The Senate Bill*

The Senate version of the Clean Water Act Amendments would have used a very different approach. In sharp contrast to the House's rather detailed requirements for analyzing thermal discharges and their related effects, the Senate Bill[139] contained no provisions specifically addressing these problems or significantly affecting the choice of intake technology. Like the House, the Senate would have included heat in its definition of a pollu-

134. 118 CONG. REC. 33,765 (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 273.

135. *See* H.R. REP. NO. 911, 92d Cong., 2d Sess. 120, *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 807.

136. *See supra* note 121.

137. *See supra* Part III.A.1.

138. S. REP. NO. 414, *supra* note 25, at 4–5, *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1422–23.

139. S. 2770, *supra* note 106.

tant.[140] Therefore, heat would have been regulated under the CWA's more general limitations and standards as found in sections 301[141] and 306.[142]

The Senate Bill offered no separate provision distinguishing the regulation of thermal discharges from any other type of water pollution. There would have been no required consideration of alternatives or mitigation measures that might influence the choice of technologies. This framework would have made unlikely a case-by-case adaptation to the unique problems of individual sites and plants. Rather than requiring the consideration of intake effects as a component of thermal discharge regulation, the Senate version would have merely mandated the establishment of general discharge standards, and left EPA free to develop a site-by-site methodology. Intakes would have only been regulated as an indirect result of the bill's regulation of technologies used to control discharges.

3. The Conference Compromise

When the two bills moved to the Conference Committee, a question remained as to whether thermal discharges were sufficiently unique to justify their own regulatory regime, as in the House Bill, or whether they were to be treated merely as another pollutant subject to the CWA's general limitations and guidelines, as in the Senate Bill. The issue of cooling water intake effects lay in the middle. The Senate Bill did not directly address intake effects.[143] Under the House approach, on the other hand, the consideration of harmful intake effects would have been an integral part of thermal discharge regulation.[144]

With little or no explanation in the formal conference report or in the debates surrounding the final version of the amend-

140. S. 2770, *supra* note 106, at § 502(f), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1697.

141. S. 2770, *supra* note 106, at § 301, *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1408–10 (detailing the CWA's general limitations on discharges of effluent).

142. S. 2770, *supra* note 106, at § 306, *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 1623–27 (providing the framework for national performance standards to be specifically delineated by EPA).

143. *See supra* Part III.A.2.

144. *See supra* notes 115–119 and accompanying text.

ments,[145] section 316 emerged as a compromise of two necessary but insufficient schemes, incorporating the Senate's basic approach to thermal discharges.[146] This conference compromise was enacted as part of the Federal Water Pollution Control Act discussed above.[147] Heat remained a pollutant in the definitions section.[148] But the consideration of intake alternatives or mitigation measures is not required for the issuance of a permit to discharge heat.

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145. *See* S. REP. No. 1236, 92d Cong., 2d Sess. (1972), *reprinted in* 1972 U.S.C.C.A.N. 3776.

146. The enacted section reads as follows:

> § 1326. Thermal Discharges.
> (a) Effluent limitations that will assure protection and propagation of balanced indigenous population of shellfish, fish, and wildlife. With respect to any point source otherwise subject to the provisions of section 1311 of this title or section 1316 of this title, whenever the owner or operator of any such source, after opportunity for public hearing, can demonstrate to the satisfaction of the Administrator (or, if appropriate, the State) that any effluent limitation proposed for the control of the thermal component of any discharge from such source will require effluent limitations more stringent than necessary to assure the projection [sic] and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made, the Administrator (or, if appropriate, the State) may impose an effluent limitation under such sections for such plant, with respect to the thermal component of such discharge (taking into account the interaction of such thermal component with other pollutants), that will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on that body of water.
> (b) Cooling water intake structures. Any standard established pursuant to section 1311 of this title or section 1316 of this title and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflects the best technology available for minimizing adverse environmental impact.
> (c) Period of protection from more stringent effluent limitations following discharge point source modification commenced after October 18, 1972. Notwithstanding any other provision of this chapter, any point source of a discharge having a thermal component, the modification of which point source is commenced after October 18, 1972, and which, as modified, meets effluent limitations established under section 1311 of this title or, if more stringent, effluent limitations established under section 1313 of this title and which effluent limitations will assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in or on the water into which the discharge is made, shall not be subject to any more stringent effluent limitation with respect to the thermal component of its discharge during a ten year period beginning on the date of completion of such modification or during the period of depreciation or amortization of such facility for the purpose of section 167 or 169 (or both) of title 26, whichever period ends first.

33 U.S.C. § 1326 (1988).

147. *See supra* note 105.

148. 33 U.S.C. § 1362(6) (1988).

Additionally, section 316(a) allows a polluter to seek a variance when EPA proposes a thermal effluent limitation for a source subject to sections 301 or 306.[149] To obtain such a variance, the polluter must show that the proposed limitation is "more stringent than necessary to assure the [protection] and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the body of water into which the discharge is to be made . . . ."[150] Upon such a showing, the Administrator is authorized to impose a less stringent thermal limitation, so long as the ecological balance is maintained.[151]

Because sections 301 and 306 concern discharges of pollutants, a special provision was necessary if cooling water intakes were to be regulated at all.[152] Thus, section 316(b), the only section of the Act dealing exclusively with intakes, states that

> [a]ny standard established pursuant to section 301 or section 306 of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.[153]

Thus, Congress created another technology standard, the "best technology available" ("BTA") for dealing exclusively with environmental problems associated with cooling water intakes. The cooling water intakes standard is to be applied whenever an intake structure is present at a point source of pollutant discharge.[154] Beyond that, however, the legislative guidance for implementing this statutory requirement is slim.[155] In the legislative history, there is minimal support for the idea that the BTA standard should be read as the "best technology available commercially at an economically practicable cost."[156] Furthermore, nothing indi-

149. 33 U.S.C. § 1326(a).

150. *Id.*

151. *Id.*

152. Section 301 is entitled "Effluent limitations." 33 U.S.C. § 1311. Section 306 is entitled "National standards of performance," which are defined as "standard[s] for the control of the discharge of pollutants . . . ." 33 U.S.C. § 1316(a)(1).

153. 33 U.S.C. § 1326(b). Presumably, this provision was meant to encompass both effluent limitations under § 301 and standards of performance under § 306.

154. *Id.*

155. The formal conference report merely reported the language of § 316(b). S. REP. No. 1236, 92d Cong., 2d Sess. 137 (1972), *reprinted in* 1972 U.S.C.C.A.N. 3776, 3814.

156. 118 CONG. REC. 33,762 (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 264 (statement of Representative Don H. Clausen).

cates whether the standards for cooling water intakes are to be written into each effluent standard and limitation developed for each industry class[157] or whether it would suffice to develop generic standards to be applied as appropriate. Moreover, Congress failed to state whether the various factors to be considered when developing standards for pollutants should be considered when developing standards for cooling water intakes.[158] Finally, Congress did not make explicit whether regulations for cooling water intakes even were required, although, as discussed below, there is actually a nondiscretionary duty to regulate which EPA has ultimately failed to meet.[159]

B. EPA, the Courts, and the Regulatory Effort under the CWA Amendments

1. EPA Regulation of Cooling Water Intakes

The Environmental Protection Agency gradually began to regulate cooling water intakes and to perform its other delegated duties under the Clean Water Act. In July 1973, EPA circulated a "draft Development Document" designed to help the regulated community make BTA determinations under section 316(b).[160] On December 13, 1973, EPA gave notice of proposed regulations under section 316(b).[161] The proposal included a new Part 402 of Title 40 of the Code of Federal Regulations, which was "intended to provide a framework for the case-by-case determination of the best technology available" as required by the statute.[162] No mandatory design and operational requirements were to be established. Rather, EPA took the position that site-specific determinations of BTA would be beneficial and that requiring certain factors to be considered as the basis for granting a permit would accommodate

157. *See* 33 U.S.C. §§ 1311, 1316.

158. Section 304 requires, without specific reference to § 316, EPA to promulgate effluent limitation guidelines relating to both §§ 301 and 306. 33 U.S.C. § 1314(b)(8)(c).

159. *See infra* Part IV.B.

160. U.S. Environmental Protection Agency, "Development Document for Proposed Best Technology Available for Minimizing Adverse Environmental Impacts of Cooling Water Intake Structures" (1973) (on file with the *Harvard Environmental Law Review*).

161. Cooling Water Intake Structures, 38 Fed. Reg. 34,410 (1973) (codified at 40 C.F.R. §§ 401–402).

162. *Id.*

this approach.[163] EPA proposed to mandate consideration of different factors influencing environmental damage with reference to a Development Document which described the types of harm associated with different intake designs in various locations and under various conditions.[164]

This proposal required industry and EPA to examine the factors set forth in Part 402 "in order to arrive at an environmentally sound decision concerning" the regulated aspects of cooling water intake structures.[165] Additionally, EPA considered it important to accommodate existing facilities that employed a variety of possible intake technologies.[166] Given these circumstances, EPA deemed it best to produce a Development Document to provide a comprehensive encyclopedia of intake structures and effects from which BTA for a particular site was to be derived.[167]

EPA used this approach in the belief that reference to an encyclopedic Development Document for BTA determinations would be the most efficient approach to achieve relatively site-specific regulation. EPA believed that, with this approach, the costs of determining BTA would be relatively small,[168] and it invited further comment from non-steam electric generating sources on their costs of studying intake effects and technologies.[169]

In responding to comments it had received on its proposed intake regulations, EPA took the position that a procedure for a completely localized site-by-site determination was improper.[170] Rather, a measure of national uniformity would be provided by requiring applicants and the permit issuing agency to refer to a single Development Document that provided for some case-by-case adaptation in determining BTA for each site.[171] Second, EPA rejected the elevation of intake location above all other considerations.[172] Third, EPA refused to rely exclusively on independent

163. *Id.*

164. As early as July 1973, EPA's Effluent Guidelines Division had circulated for comments a draft report on the costs and the environmental effects of various intake systems that might be used by the steam electric power industry, *see supra* note 160, and formally announced its availability. 38 Fed. Reg. 34,410.

165. 38 Fed. Reg. 34,410.

166. *Id.* at 34,411.

167. *See supra* note 164 and accompanying text.

168. 38 Fed. Reg. at 34,411.

169. *Id.*

170. *Id.*

171. *Id.*

172. *Id.*

research organizations for the gathering of biological data.[173] Finally, EPA expressed a desire for further commentary on how final regulations should distinguish between existing and new structures, and between large and small volume intakes.[174]

In 1974, EPA promulgated the "General Provisions" section of the "Effluent Guidelines and Standards" subchapter in Title 40 of the Code of Federal Regulations.[175] Those provisions cited section 316(b) as one source of authority.[176] In October of that year, EPA promulgated effluent guidelines and standards for the Steam Electric Power Generating point source category.[177] EPA's new source standards had been specifically required by the Act.[178] EPA stated that cooling water intake regulations for all other point sources would appear in a separate part of the Code of Federal Regulations.[179]

Both EPA and the electric utility industry had extensively studied the economics of cooling water intake regulation by the time EPA proposed the final regulations under section 316(b).[180] In its first annual report to Congress pursuant to section 516(b) of the CWA,[181] EPA estimated that achieving a zero discharge of thermal pollutants by 1983, depending on the number of exemptions granted, would increase consumer electric bills by 1.7% to 6.1%.[182]

In 1976, EPA published its final Cooling Water Intake Regulations.[183] The next year, a more specific study addressing the economic impacts of regulating cooling water intakes analyzed a range of impact control options across the steam electric gener-

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173. *Id.*

174. *Id.*

175. Effluent Guidelines and Standards—General Provisions, 39 Fed. Reg. 4532 (1974) (codified at 40 C.F.R. § 401).

176. *Id.* at 4532.

177. Steam Electric Power Generating Point Source Category, 39 Fed. Reg. 36,186 (1974) (codified at 40 C.F.R. § 423).

178. 33 U.S.C. § 1316(b) (1988).

179. 39 Fed. Reg. 36,186, 36,186 (stating that purpose of notice was to establish final effluent guidelines and limitations for existing sources and to establish standards of performance and pretreatment standards for new sources in steam electric generating category by amending 40 C.F.R. ch.1 subchapter N to include new Part 423).

180. 38 Fed. Reg. 34,410 (1973).

181. 33 U.S.C. § 1375(b) (1988).

182. U.S. EPA, THE ECONOMICS OF CLEAN WATER—1973, ANNUAL REPORT OF THE ADMINISTRATOR, 93d Cong., 2d Sess. 6 (Comm. Print No. 20, 1974).

183. Cooling Water Intake Structures, 41 Fed. Reg. 17,387 (Apr. 26, 1976) (codified at 40 C.F.R. §§ 401.14, 402).

ating industry.[184] The study concluded that the most stringent regulatory requirement—substantial reduction in cooling water volume—could increase consumer electric bills by approximately ten percent.[185] However, when considering all technologies available to the industry, even a "worst case" scenario for cooling water intake regulation costs represented less than a one percent increase in capital expenditures, operating and maintenance expenses, and annual revenue requirements.[186] EPA thus tried to establish that control of thermal discharges and concomitant reductions in adverse environmental impacts by cooling water intakes could be

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184. TEMPLE, BARKER & SLOANE, INC., ECONOMIC ANALYSIS OF SECTION 316 REGULATIONS ON THE STEAM ELECTRIC POWER GENERATING INDUSTRY (1977) [hereinafter ECONOMIC ANALYSIS], *reprinted in* SENATE COMM. ON ENV'T. & PUB. WORKS, COMM. PRINT NO.6, 96TH CONG., 1ST SESS., THE STATUS OF ENVIRONMENTAL ECONOMICS: AN UPDATE 282–301 (1979) [hereinafter ECONOMICS UPDATE].

185. ECONOMIC ANALYSIS, *supra* note 184, at 16 tbl. 6, *reprinted in* ECONOMICS UPDATE, *supra* note 184, at 299. The report pointed out that the actual effects among customers of a single electric company would be an average of compliance costs. ECONOMIC ANALYSIS, *supra* note 184, at 15, *reprinted in* ECONOMICS UPDATE, *supra* note 184, at 298. The range of increases in consumer costs extended from less than one-tenth of one percent (for small mesh screens on existing intake screens) to ten percent for closed-cycle cooling system retrofits necessary to reduce intake volume. ECONOMIC ANALYSIS, *supra* note 184, at 16 tbl. 6, *reprinted in* ECONOMICS UPDATE, *supra* note 184, at 299.

186. The report concluded that

> [t]he costs and revenue requirements which will result from compliance with the 316(b) regulations at the national level can be put into perspective by comparing them to projections of all other costs and required revenues for the electric utility industry. The capital expenditures for 316(b) compliance represent a 0.3 percent increase in the $294 billion (1977 dollars) the industry is expected to spend between 1978 and 1987 for plant construction, excluding pollution control related facilities. The increase in annual operating and maintenance expenses will be about 0.15 percent in 1987. The increase in annual revenue requirements will amount to a 0.2 percent increase over electric utility industry revenue requirements for 1987.
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> . . .
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> The national level impacts . . . were based on conservative (i.e., worst case) assumptions as to the type of 316(b) controls which would be required at each plant . . . . Since it can reasonably be expected that not all the potentially impacted plans [sic] will be required to install 316(b) controls, and that not all questionable cases will require the more expensive technology, the national level costs should be lower than [predicted].

ECONOMIC ANALYSIS, *supra* note 184, at 17–18, *reprinted in* ECONOMICS UPDATE, *supra* note 184, at 300–01. Temple, Barker and Sloane, Inc., reported on industry-wide costs of environmental compliance with federal air and water regulations in a separate report. TEMPLE, BARKER & SLOANE, INC., EPA-230/3-76-013, ECONOMIC AND FINANCIAL IMPACTS OF FEDERAL AIR AND WATER POLLUTION CONTROLS ON THE ELECTRIC UTILITY INDUSTRY (1976), *reprinted in* ECONOMICS UPDATE, *supra* note 184, at 302–36.

achieved by converting existing cooling systems to closed-cycle cooling towers without undue economic impact. In other words, EPA's economic analysis established a de facto "best technology" standard. Point sources could be reasonably expected to use closed-cycle cooling systems—the systems that truly minimized adverse environmental impacts.

EPA's approach seemed to be that reference to a Development Document would naturally accomplish the unstated goal of setting closed-cycle cooling as the Best Technology Available. The economic studies were designed to preemptively defeat potential claims by regulatees that the cost of closed-cycle cooling was disproportionate to its benefits.[187] EPA thus prescribed and prepared to defend a method of regulation designed to reach closed-cycle cooling without directly requiring it.[188]

2. EPA Regulations in the Courts

The industry began vigorous and successful challenges to EPA's regulations under both sections 316(a) and 316(b) in the courts. EPA's first major defeat in its attempts to regulate point sources under section 316 occurred in 1976 in *Appalachian Power Co. v. Train.*[189] EPA had promulgated variance regulations under section 316(a) that ultimately required closed-cycle cooling for all major thermal electric generating facilities and new small generators.[190] The Fourth Circuit found that EPA had provided inadequate justifications for this approach and, as a result, the court remanded the regulations.[191] Although the Agency had determined that the economic costs of retrofitting steam electric plants with once-through cooling to closed-cycle systems were acceptable, the court faulted EPA's failure to compare those costs to levels of

187. The Agency completed its analysis of the cost of different methods of controlling thermal discharge in 1976. *See infra* note 192 and accompanying text.

188. Cooling Water Intake Structures, 41 Fed. Reg. 17,387 (1976). At nearly the same time, EPA issued a draft guidance manual for conducting evaluations of adverse environmental impacts for purposes of § 316(b). Guidance Manual, *supra* note 12. A final version of the manual was never issued.

189. 545 F.2d 1351 (4th Cir. 1976) [hereinafter *Appalachian Power I*].

190. 40 C.F.R. §§ 125.70–125.73 (1991).

191. *Appalachian Power I*, 545 F.2d at 1359.

environmental benefit.[192] However, the variance procedures for thermal effluent[193] were allowed to stand.[194] Although the case did not discuss the BTA requirement of section 316(b), had EPA's 316(a) regulations been upheld, the issues today concerning cooling water intake structures would have been vastly less significant.

In the second *Appalachian Power Co. v. Train*[195] case, a group of fifty-eight utility companies successfully challenged EPA's section 316(b) intake structure regulations.[196] EPA merely had reiterated the language of the statute and simply had referred regulatees to the Development Document[197] for determinations of the appropriate intake system. The court held that the Administrative Procedure Act[198] required either publication in the Federal Register of "substantive rules of general applicability"[199] or completion of a process or incorporation by reference for such rules.[200] Because the Development Document itself was never published in the Federal Register and because EPA never followed the proper incorporation procedure, the regulations' attempt to incorporate the Development Document was held invalid and remanded to EPA.[201] They were formally withdrawn in 1979.[202]

The Fourth Circuit never reached the substantive merits of the regulations, ruling that they were "presently ineffective to impose obligations upon, or to adversely affect" utilities.[203] The court's conclusion that the Development Document was a sub-

192. *Id.* at 1374–75. The court also found error in EPA's refusal to explain its unwillingness to grant an exemption from the retrofit requirement for 55 nuclear plants, *id.* at 1366–67, and in its determination that sea water cooling towers represented best technology available for coastal plants. *Id.* at 1371.

193. 40 C.F.R. §§ 125.70–125.73 (1991).

194. *Appalachian Power I*, 545 F.2d at 1372.

195. 566 F.2d 451 (4th Cir. 1977) [hereinafter *Appalachian Power II*].

196. Cooling Water Intake Structures, 41 Fed. Reg. 17,387 (1986). Additionally, one party unsuccessfully argued that § 316(b) did not apply to point sources other than steam electric generating facilities. The court rejected this argument, however, on the basis of statutory language. *Appalachian Power II*, 566 F.2d at 457–58. The Seventh Circuit had reached the same conclusion on this issue a few months earlier in United States Steel Corp. v. Train, 556 F.2d 822, 849–50 (7th Cir. 1977); *see also infra* notes 207–214 and accompanying text.

197. DEVELOPMENT DOCUMENT, *supra* note 56.

198. 5 U.S.C. §§ 551–559, 701–706 (1988).

199. *Id.* § 552(a)(1)(D).

200. 1 C.F.R. § 51 (1992).

201. *Appalachian Power II*, 566 F.2d at 457.

202. 44 Fed. Reg. 32,956 (1979).

203. 566 F.2d at 457.

stantive rule of general applicability,[204] despite its lack of specific cooling water intake system standards, suggests that EPA may not utilize informal regulation methods to achieve a uniform national approach to cooling water intake issues.[205]

Despite this remand, the courts have continued to define the contours of permissible EPA action on § 316(b) issues. For example, the courts have held that § 316(b) is applicable through CWA's permitting provisions. In *United States Steel Corp. v. Train*, U.S. Steel sought judicial review of a denial of a National Pollution Discharge Elimination System ("NPDES")[206] permit for its Gary, Indiana works.[207] One of the challenged permit conditions required United States Steel "to conduct an intake monitoring program, as part of a study of the environmental impact of the cooling-water intakes . . . and to submit a proposal for meeting the [requirements of] section 316(b)."[208] Based on its interpretation of the legislative history, U.S. Steel unsuccessfully argued that because it was not a steam-electric generating facility, the requirements of section 316(b) did not apply to its permit.[209] In addition, U.S. Steel asserted that because section 402(a)(1)[210] lists those sections with which NPDES permits must comply and does not

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204. *Id.* at 454.

205. *See supra* note 171 and accompanying text; *see also infra* Part IV.B. In Virginia Electric & Power Co. v. Costle, 566 F.2d 446 (4th Cir. 1977), a companion case, the Fourth Circuit addressed only the question of the proper court for reviewing a regulation issued by EPA under § 316. In that case, the same 58 utilities that brought suit in *Appalachian Power II* sought review in a United States District Court of EPA's regulations under § 316(b). The case was dismissed for lack of jurisdiction under the Clean Water Act's judicial review provision. *Id.* at 450–51 (citing CWA § 509(b)(1)(E), 33 U.S.C. § 1369(b)(1)(E) (1988)). The decision turned on whether the § 316 regulations were "effluent limitation[s] or other limitation[s] under section 301, 302, or 306," such that they were only reviewable in the United States Courts of Appeals. *Id.* at 449. The court found sufficient similarity between the § 316 regulations and other effluent limitations or standards to hold that the new regulations were reviewable in the first instance only in the Circuit Courts. *Id.* at 450–51.

206. The NPDES is the standard permitting system under the Clean Water Act. *See* 33 U.S.C. § 1342 (1988).

207. United States Steel Corp. v. Train, 556 F.2d 822, 849–50 (7th Cir. 1977).

208. *Id.* at 849.

209. U.S. Steel claimed that a comment in the legislative history stating that "§ 316(b) applies to steam electric facilities" suggested that the regulation was inapplicable to cooling water intakes at other kinds of sources. However, because the comment had been uttered in the context of an example, the court found the legislative history "ambiguous at best." *Id.* at 850 n.55 (*referring to* 118 CONG. REC. 33,761 (1972), *reprinted in* LEGISLATIVE HISTORY, *supra* note 100, at 264 (statement of Representative Don H. Clausen)).

210. 33 U.S.C. § 1342(a)(1) (describing normal NPDES permit issuance process).

include section 316,[211] EPA may not condition NPDES permits on section 316(b) compliance.[212]

Rejecting this argument, the court held that, in accordance with its plain language, section 316(b) applies to cooling water intakes at *all* point sources.[213] Even more significantly, the court found that section 316(b) was clear that the its "requirements are to be implemented through standards established pursuant to sections 301 and 306," sections which are included in the section 402(a)(1) list. Thus, the court correctly determined that section 402(a)(1) "implicitly requires the Administrator to insure compliance with section 316(b) as one of the permit conditions."[214]

Since the time that the section 316(b) regulations were remanded, no federal court has reviewed an EPA decision that require a facility to install or retrofit to closed-cycle cooling. Litigation concerning the Hudson River power plants in New York has come the closest,[215] but those issues ultimately were settled in the now historic Hudson River Settlement Agreement.[216] However,

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211. The provision states that

> [T]he Administrator may . . . issue a permit . . . upon condition that such discharge will meet either (A) all applicable requirements under sections 1311, 1312, 1316, 1317, 1318, and 1343 of this title, or (B) prior to the taking of necessary implementing actions relating to all such requirements, such conditions as the Administrator determines are necessary to carry out the provisions of this Act.

33 U.S.C. § 1342(a)(1) (1988).

212. *United States Steel Corp.*, 556 F.2d at 849.

213. *Id.* at 849–50. Section 316(b) reads, in relevant part, "Any standard . . . applicable to a point source . . . ." 33 U.S.C. § 1326(b) (1988).

214. *United States Steel Corp.*, 556 F.2d at 850. The court also found that the regulation's impact study requirement was well within the Administrator's authority under § 308, 33 U.S.C. § 1318 (authorizing EPA to perform inspections and to require reports and records). *United States Steel Corp.*, 556 F.2d at 850; *see also In re* Youngstown Sheet & Tube Co., Decision of EPA General Counsel No. 32, 137, 141 (1975) (holding that § 308 affords ample opportunity for inclusion of study and monitoring requirements).

215. Central Hudson Gas & Elec. Corp. v. EPA, 587 F.2d 549 (2d Cir. 1978).

216. Hudson River Settlement Agreement (Dec. 19, 1980), *reprinted in* NEW YORK UNIV. SCH. OF LAW & NRDC, *supra* note 86, at 148–203. Controversy surrounding the cooling water intakes at several Hudson River power plants ended for some time with the settlement agreement. *Id.* The settlement agreement expired in May 1991, although the permits at Indian Point will not expire until October 1992. *See* Complaint, Natural Resources Defense Council, Inc. v. New York State Dept. of Envt'l Conservation (No. 6570-91, N.Y. Sup. Ct.) (Sept. 13, 1991) [hereinafter Complaint] (on file with the *Harvard Environmental Law Review*). In the meantime, the New York Department of Environmental Conservation has entered a letter agreement calling for voluntary continuation of mitigation measures by the utilities until permit renewal. N.Y. Dep't Envt'l Conservation, Letter

the courts have reviewed EPA decisions that have refused to require closed-cycle cooling. The results of these cases reinforce EPA's regulatory abdication.

In one such case, EPA's decision to not require closed-cycle cooling or deep water intakes at the Seabrook nuclear power plant was reviewed.[217] The First Circuit upheld this decision,[218] affirming EPA's determination that it was improper to impose a permit condition with a cost "wholly disproportionate" to the related environmental benefit.[219] However, the court's decision in this case seemed to be based more on deference to the Agency than on any finding by the court that the existing cooling system complied with the statute. Several issues respecting the minimization of environmental harm were raised by the challengers, the Seacoast Anti-Pollution League.[220] But the court, in a move consistent with current law's deference to agency determinations,[221] accepted the Administrator's finding that, despite his decision's failure to minimize such harms, agency discretion permitted this interpretation of the statute.[222]

The court's opinion did not directly address EPA's cost analysis rationale. But the court implicitly adopted a mild standard of review for section 316(b) determinations that did not require the Agency to conduct formal cost-benefit analysis;[223] that accepted EPA's approval of an intake structure that would not actually minimize adverse environmental impacts, at least when costs were wholly disproportionate to the marginal benefit obtained; and that acquiesced to an EPA decision not to require impact minimization even though evidence demonstrating remediable environmental

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Agreement Re: Bowline, Roseton & Indian Point SPDES Permits (May 15, 1991) [hereinafter Letter Agreement] (on file with the *Harvard Environmental Law Review*). NRDC has initiated litigation over the legality of the letter agreement. *See* Complaint.

217. *See In re* Public Service Co. of New Hampshire, 10 Env't Rep. Cas. (BNA) 1257 (E.P.A. 1977).

218. Seacoast Anti-Pollution League v. Costle, 597 F.2d 306 (1st Cir. 1979).

219. *Id.* at 311 (relying upon statement of Representative Don H. Clausen, quoted in LEGISLATIVE HISTORY, *supra* note 100, at 264).

220. *Id.* at 309–11 (discussing the Agency's decision on the location of intake structures and the intake velocity).

221. *See* Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc., 467 U.S. 837, 843–45 (1984).

222. *Seacoast Anti-Pollution League*, 597 F.2d at 311.

223. In his review of the Regional Administrator's recommended § 316(a) variance, the Administrator specifically had rejected the utility companies' argument that formal cost-benefit analysis was required under the legislative history. *In re* Public Service Co. of New Hampshire, 10 Env't Rep. Cas. (BNA) 1257, 1261 (E.P.A. 1977).

impact was before the agency decisionmaker.[224] When this deference is combined with an absence of regulatory standards, EPA decisions to not require improvements in intake technology under section 316(b) have been rendered virtually immune from substantive judicial review.

The power under section 316(b) to directly address intake effects was further eroded in *Consolidated Edison Co. v. New York State Department of Environmental Conservation*,[225] the most recent federal court decision concerning this section. The state of New York had issued and administered NPDES permits for power plants on the Hudson River under section 402 of the Clean Water Act.[226] Plaintiff Consolidated Edison sought a determination of the legality of proposed permit conditions pertaining to cooling water intake structures at two of its plants.[227] It claimed that the conditions were improper under the CWA and beyond the authority of the Department of Environmental Conservation.[228] The court dismissed the federal claims for lack of jurisdiction,[229] finding that a challenge to state-imposed permit conditions did not raise a federal question under the CWA.[230] Moreover, the court held that the existence of the Hudson River Settlement Agreement, to which EPA was a party, did not in itself vest jurisdiction in the federal courts.[231]

In marshalling arguments to justify denying federal jurisdiction for lack of a federal question, the district court engaged in a curious consideration of intake regulation under federal law. The court found that conflicting precedents[232] rendered unclear whether there was a federal policy or interest involving cooling water intakes sufficient to justify the application of federal common law to the

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224. *Seacoast Anti-Pollution League*, 597 F.2d at 311.

225. 726 F. Supp. 1404 (S.D.N.Y. 1989).

226. 33 U.S.C. § 1342(b) (1988).

227. *Consolidated Edison Co.*, 726 F. Supp. at 1407.

228. *Id.*

229. *Id.* at 1411.

230. *Id.* at 1409. The court relied upon Middlesex County Sewerage Auth. v. National Sea Clammers Ass'n, 453 U.S. 1 (1981) (holding that no implied federal right of action exists under CWA).

231. *Consolidated Edison Co.*, 726 F.Supp. at 1410.

232. *Compare* Natural Resources Defense Council v. EPA, 859 F.2d 156, 170 (D.C. Cir. 1988) (EPA "is powerless to impose permit conditions unrelated to the discharge itself") *with* United States Steel Corp. v. Train, 556 F.2d at 850 ("§ 402(a)(1) implicitly requires the Administrator to insure compliance with § 316(b) as one of the permit conditions"); *see also supra* notes 207–214 and accompanying text.

case.[233] As a consequence, the court rejected the notion that there was a clear federal interest in intake issues and blocked the application of federal common law to intake problems as a means of correcting for the lack of regulation.

Despite the court's characterization, there is a substantial federal interest in regulating cooling water intakes. Specifically, section 316(b)'s requirements for intakes arise under the Clean Water Act and are directly tied to the Act's general effluent limitations and standards.[234] Moreover, the velocity and volume of intake flow, chief factors affecting entrainment and impingement, are inversely proportional to the thermal discharge in the effluent stream of a once-through system. Thus, intake velocity and volume and its impacts are directly related to thermal effluent limitations.[235]

On the other hand, it may be fair to question EPA's commitment to a policy of regulating intake effects in light of its failure to formally regulate the subject and the long period of inaction since it withdrew of the initial regulatory provisions. Essentially, EPA has demonstrated no interest in these issues for more than a decade. Absent such a showing, it would be unfair to hold permittees to any ad hoc conditions imposed on the basis of the statute alone. Nevertheless, EPA cannot repeal a statutory mandate simply by ignoring it for a long period of time.[236]

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233. *Consolidated Edison Co.*, 726 F. Supp. at 1410. The court seemed to raise the issue of a federal policy of intake regulation only for the purpose of finding that the Hudson River Settlement Agreement had waived any possible federal policy interest. *See id.* at 1406. The court referred to § 3.B(i) of the Settlement Agreement, which states that the New York Department of Environmental Conservation

> in accordance with applicable law, shall issue to each of the Utilities NPDES permits for their respective Hudson River plants which will permit, during the entire ten-year term of this Agreement, continued operation with the existing once-through cooling systems unaltered by thermal or intake requirements . . . .

Hudson River Settlement Agreement 17 (Dec. 19, 1980), *reprinted in* NEW YORK UNIV. SCH. OF LAW & NATURAL RESOURCES DEFENSE COUNCIL, *supra* note 86, at 165.

234. 33 U.S.C. § 1326(b) (1988) (outlining requirements for "[a]ny standard established pursuant to section 1311 [CWA § 301] of this title or section 1316 [CWA § 306] of this title and applicable to a point source . . .").

235. *See, e.g.*, *supra* note 96 and accompanying text.

236. EPA General Counsel contended that authority to regulate under § 316(b) was not dependent on the prior issuance of thermal effluent limitations, and that cooling water intake limitations could be imposed under authority of § 402(a)(1). Effective Date of Section 316(b), FWPCA Volume 2, Op. EPA Gen. Counsel (Jan. 17, 1973), *reprinted in* United

3. Agency Adjudications

The case law under section 316(b) suggests that EPA accomplished very little in its effort to regulate cooling water intakes.[237] However, a rather detailed administrative "common law" developed as the Agency attempted to apply congressional mandates concerning both intakes and thermal discharges. This development established basic legal rules regarding section 316(b)[238] and a protocol for the application of the statute to particular intakes,[239] the contours of which are discussed below. Two such rules emerged from the administrative process while EPA was developing its cooling water intake regulations.

The first rule involved the technical question of whether a facility had submitted sufficient information for EPA to make a BTA determination.[240] EPA asserted early that under section 316(b) the Agency had the burden of determining whether a permit applicant's proposed or existing cooling water intake structure represented the best technology available for minimizing adverse environmental impacts.[241] In order to render this determination,

States Environmental Protection Agency General Counsel Opinions (Envt'l. L. Pub. Serv.) 133 (1979) [hereinafter EPAGCO]; *see also infra* note 241.

237. *See supra* notes 195–236 and accompanying text.

238. *See infra* notes 245–247 and accompanying text.

239. *See infra* notes 248–253 and accompanying text.

240. EPA's authority to require provision of such information had previously been established. *See* 33 U.S.C. § 1318 (authorizing EPA to conduct inspections and to require the regulated to produce reports and records).

241. *See* Central Hudson Gas & Elec. Corp., Op. EPA Gen. Counsel No. 63 (July 29, 1977), *reprinted in* EPAGCO, *supra* note 236, at 371 (holding that "under Section 316(b) EPA has the ultimate burden of persuasion").

General Counsel Opinion No. 63 provides a comprehensive guide to EPA's view of § 316(b) requirements. To paraphrase, the decision found that (1) in the absence of regulations under § 316(b), the EPA has authority under § 402 to impose such conditions as are necessary to carry out §§ 301 and 306; (2) cooling systems involving cooling towers are not cooling water intake structures subject to the requirements of § 316(b); (3) permit issuing authorities are not required to establish a thermal effluent standard for a facility prior to imposing requirements under § 316(b); (4) § 316(b) applies to both new and existing facilities; (5) because § 316(b) applies to the design, location, construction or capacity of intake structures, conditions imposed under that section may not take the form of effluent limitations; (6) the EPA can impose § 316(b) limitations on capacity (volume) that preclude the satisfaction of thermal effluent limitations with existing cooling systems; (7) §§ 316(a) and 316(b) represent independent requirements, though where the utility demonstrates that thermal effluents will ensure the protection of a balanced indigenous population of aquatic wildlife (the standard for a § 316(a) variance, *see* § 316(a), 33 U.S.C. § 1326(a)) the EPA bears the burden of demonstrating that present value costs of satisfying the capacity restrictions are not wholly disproportionate to the benefits to be achieved by the intake restrictions; and (8) EPA is required to ensure that every limitation imposed under § 316(b)

EPA used its power under section 308[242] to require the submission of information about the intake structure and its effects.[243] Thus, prior to the issuance of a draft permit for the facility, EPA required a "Section 316(b) Demonstration" report from the utility. EPA then reviewed the report and rendered an initial BTA determination, although that assessment did not need to be reflected in the final permit.[244]

To be acceptable, a permit applicant's section 316(b) Demonstration submission must contain "the best information reasonably available,"[245] and should "enable the applicant to project in both absolute and relative terms the species adversely affected so that the impact on the relevant population can be estimated with some degree of confidence."[246] This information enabled EPA to carry out its statutory mandate to "assess the level of environmental impact caused by [the] intake structure, estimate its magnitude, identify the technologies available to minimize the impact, and review the cost of such measures to assure that it [was] not wholly out of proportion to the protection achieved."[247]

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is accompanied by clear written notice of the basic factual and legal determinations which underlie the permit conditions. *Id.*, *reprinted in* EPAGCO, *supra* note 236, at 371–84.

242. 33 U.S.C. § 1318. *See supra* note 240.

243. This power was upheld in United States Steel Corp. v. Train, 556 F.2d 822, 850–51 (7th Cir. 1977).

244. Regulations allow this determination to be made prior to finalization of the draft permit. 40 C.F.R. § 124.66 (1991) (procedures for decisionmaking under NPDES permit programs). Once a facility demonstrates that its intake structure represents BTA, it seems unnecessary to include permit terms unless they relate to operational, monitoring, or performance requirements. Section 316(b) regulates intakes with technology-based standards rather than performance levels, therefore, most permits contain no intake conditions.

245. Pilgrim Nuclear Station Units 1 & 2, EPA Reg. I Administrator 15 (Mar. 11, 1977) (Final Permit Determination) [hereinafter Pilgrim Nuclear Station] (on file with the *Harvard Environmental Law Review*).

246. *Id.* The evidence submitted should include

> 1) identification of major aquatic species in the water source, including estimates of population density for each species identified; 2) disclosure of the temporal and spatial distribution of the identified species; 3) data on source water temperature for a full year; 4) documentation of fish swimming capabilities for the species identified, at the intake's anticipated temperature range, under conditions simulating those at the intake; 5) description of the intake location with respect to the seasonal and diurnal spatial distribution of identified aquatic species.

Id. at 34. EPA also may reconsider the effects of an entire generating facility when new units are to be added. *See* Big Bend Unit No. 4, Tentative Findings & Det. EPA Reg. IV Administrator 5 (June 12, 1981) (on file with the *Harvard Environmental Law Review*).

247. Pilgrim Nuclear Station, *supra* note 245, at 19 (discussing the difficulty of and EPA's refusal to impose a closed-cycle requirement). *See also* L.C. WENDLING ET AL.,

The second development in EPA's administrative process for intake issues was the Agency's two-step "rule of decision" with respect to the requirement that the Agency consider minimizing adverse impacts when making its BTA determination. EPA adjudications identified and required consideration of a generic list of major adverse impacts.[248] By 1978, administrative opinions established that the minimization component of BTA determinations involved two steps.[249] First, EPA determined the alternative technologies[250] necessary to reduce, but not necessarily eliminate, adverse[251] impacts.[252] Second, EPA assessed these technologies for the economic proportionality of cost to benefit obtained, although formal cost-benefit analysis was not required.[253]

In addition to these rules developed through adjudication, EPA further developed the outlines of its approach to section 316(b) by providing regulatory guidance for permit renewal or reissuance.[254] This guidance consisted of a 1988 memorandum prepared by a panel of national experts at EPA's request.[255] The memorandum's discussion of section 316(b) issues was limited to

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REVIEW AND EVALUATION OF THERMAL EFFECTS STUDIES AND COOLING WATER INTAKE STRUCTURE DEMONSTRATIONS OF IMPACT FOR THE BERGEN, HUDSON, KEARNY, LINDEN, AND SEWAREN GENERATING STATIONS: FIRST PROGRESS SUMMARY IV-24 to IV-25 (1989) (prepared for New Jersey Department of Environmental Protection) [hereinafter N.J. REPORT] (on file with the *Harvard Environmental Law Review*).

248. The Pilgrim opinion listed these impacts as

> (1) decrease in threatened or endangered species, (2) increase in nuisance species, (3) decrease in the indigenous species, (4) damage to any critical aquatic organism, such as important elements of the food chain, (5) change in population composition and (6) decrease in commercial or sport fisheries.

Pilgrim Nuclear Station, *supra* note 245, at 16–17.

249. *See supra* note 247 and accompanying text.

250. The range of alternatives available to mitigate impacts included variations in factors relevant to determining adverse impacts—location, design, construction, and capacity. An intake proposal that does not utilize intake technologies that incorporate all of these considerations fails to represent the best technology available for minimizing adverse impact. Brunswick Unit Nos. 1 & 2, Initial Decision, EPA Reg. IV Administrator 71–72 (Nov. 7, 1977) [hereinafter Brunswick] (on file with the *Harvard Environmental Law Review*).

251. "Adverse" was defined, in its ordinary sense, to mean "harmful," as opposed to the industry offered definition of "irreversible." *Id.* at 28–31.

252. *See supra* note 247 and accompanying text.

253. Pilgrim Nuclear Station, *supra* note 245, at 16; Brunswick, *supra* note 250, at 61–62.

254. Under § 402(b)(1)(B) of the Clean Water Act, a permit term may not exceed five years. 33 U.S.C. § 1342(b)(1)(B) (1988).

255. EPA Region IV, 316 Guidance for Permit Reissuance (Oct. 13, 1988) (on file with the *Harvard Environmental Law Review*).

a description of a 1982 legal opinion of the EPA Office of General Counsel.[256] In that opinion, the Agency stated first that, in the course of permit renewals, regulators are not bound by past determinations of BTA from prior permit issuances or renewals.[257] Second, the opinion found that, under section 308, agencies may require new biological monitoring programs or studies,[258] or simply may rely upon information submitted in the course of the earlier BTA determination.[259] Third, the opinion also stated that, under section 316(c) of the CWA,[260] BTA determinations may not be made more stringent for a period of ten years following facility construction or modification.[261] This assertion misinterprets the statute, however, because section 316(c) only provides ten-year protection from thermal effluent limitations; it does not refer to BTA determinations on cooling water intakes at all. Nonetheless, these three findings allow EPA to leave prior BTA determinations intact during renewals, making the effect of the Agency's decisions on permit renewals substantively depend on the form of the initial issuance regulations.

Given the lack of federal regulations, the extant policy and regulatory statements are a somewhat incoherent patchwork of information. Though each is helpful, none is enforceable. This state of affairs, as this Article discusses below, is contrary to rational arguments derived from the statutes and the objectives of environmental protection.

C. EPA's Inaction

Since the Fourth Circuit remanded regulations under section 316(b), EPA has not issued new regulations or even proposals for

256. Legal Opinion on § 316 of the Clean Water Act, Op. EPA Gen. Counsel 5–8 (Feb. 24, 1982) [hereinafter Legal Opinion] (on file with the *Harvard Environmental Law Review*).

257. *Id.* at 6; *see also* 40 C.F.R. § 122.62(a) (1991) (listing causes for modification of permits).

258. Legal Opinion, *supra* note 256, at 7.

259. *Id.* at 6. The legal opinion also refers to the preamble to the 1979 NPDES regulations, National Pollution Discharge Elimination System (NPDES) Program Revisions, 44 Fed. Reg. 32,854, 32,894 (1979) (preamble) (stating that a regulator has discretion to rely on previously submitted data when ecological conditions have not significantly changed).

260. 33 U.S.C. § 1326(c) (1988) (creating a 10-year grandfather clause to protect entities that improve thermal discharge systems from increases in the rigor of regulation) (quoted *supra* note 146).

261. Legal Opinion, *supra* note 256, at 6.

new regulations. Instead, EPA has opted for a case-by-case treatment of cooling water intake requirements, even though it has taken regulatory action concerning related issues.[262] Given intake structures at more than one thousand electric power generating units in the United States,[263] it is remarkable that the Agency has chosen such an onerous burden, especially considering that the renewal of permits issued under the NPDES program occurs every five years.[264]

In fact, however, the EPA has not assumed such an enormous burden. Most states now administer delegated NPDES programs.[265] And in the very few states doing anything at all about cooling water intake effects,[266] EPA regional offices virtually never engage in review of these intake effects or BTA determinations upon permit renewal.[267] Without federal regulations, state officials lack authoritative guidance for their own regulatory efforts, and EPA regional administrators have no national standards to apply to state regulatory decisions. Finally, despite an EPA opinion stating that the Agency has the discretion to reconsider previous BTA declarations,[268] EPA practice seems to be that once best technology determinations are made, they need never be revisited upon permit renewal.[269]

Although issuing regulations would simplify the regulation of cooling water intake structures, EPA's failure to promulgate any

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262. These regulatory activities include establishment of the consolidated permit program, with a specific provision allowing § 316(b) determinations prior to final permit issuance, 45 Fed. Reg. 33,290 (1980) (replacing 40 C.F.R. §§ 122–124); extensive revision of Steam Electric Power Generating Point Source Category Guidelines and Standards, 47 Fed. Reg. 52,290 (1982) (amending 40 C.F.R. § 423); establishment of special public notice requirements to accompany variances under § 316(a), 48 Fed. Reg. 14,278 (1983) (codified at 40 C.F.R. § 124.661); and amendment to Steam Electric Power Generating Point Source Category regulations, 48 Fed. Reg. 31,404 (1983) (codified at 40 C.F.R. §§ 423.12, 423.13, 423.15). Since Appalachian Power Co. v. Train, 556 F.2d 451 (4th Cir. 1977), EPA has amended 40 C.F.R. § 125 five times. This section contains, in a "reserved" status, "Subpart I—Criteria Applicable to Cooling Water Intake Structures under Section 316(b) of the Act." *See* 44 Fed. Reg. 32,854 (1979); 48 Fed. Reg. 14,293 (1983); 49 Fed. Reg. 38,052 (1984); 50 Fed. Reg. 6941 (1985); 54 Fed. Reg. 257 (1989).

263. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 1-1 to 1-345.

264. 33 U.S.C. § 1342(b)(1)(B) (1988).

265. *See* Katherine Fletcher, *Protecting Puget Sound: An Experiment in Regional Governance*, 65 WASH. L. REV. 359, 367 n.38 (1990).

266. *See infra* Part III.E.

267. *See* Rábago, *supra* note 63, at 15.

268. *See supra* text accompanying notes 257–258.

269. Rábago, *supra* note 63, at 15. This assertion is based upon data collected on the Atlantic coast that reflect EPA permit renewal practices. *Id.* at Tab A.

federal regulations made the problem virtually disappear from the Agency's agenda. It appears that this situation will continue until either a court or Congress directly requires EPA to change it.

D. Congressional Inaction

Congress has revisited the Clean Water Act on several occasions since 1972, enacting major amendments in 1977,[270] in 1981,[271] and, most recently, in 1987.[272] Major amendments to the CWA are currently pending in Congress.[273] Although both industry and EPA have promoted revisions of section 316(a) and (b) in the past,[274] Congress has never changed the section.

Congress accorded the most attention to any proposal for amending section 316 during the 1982 hearings on proposed amendments to the CWA.[275] EPA proposed that Congress create two section 316(b) standards, one for new sources, and another for existing sources.[276] New sources, regulated under section 306, would still have to utilize the best technology available for minimizing adverse environmental impact.[277] Existing point sources with cooling water intake systems, on the other hand, could satisfy the Act by applying either the best technology available or "other equally effective measures" that alone or in combination with "best available technology" would minimize adverse impact.[278]

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270. Clean Water Act Amendments of 1977, Pub. L. No. 95-217, 91 Stat. 1566 (1977).

271. Clean Water Act Amendments of 1981, Pub. L. No. 97-117, 95 Stat. 1631 (1981).

272. Clean Water Act Amendments of 1987, Pub. L. No. 100-4, 101 Stat. 7 (1987).

273. *See, e.g.*, S. 1081, 102d Cong., 1st Sess. (1991).

274. S. 2652, 97th Cong. 2d Sess. (1982) (sponsored by Senators Chaffee, Stafford, and Randolph); *see Clean Water Act Amendments of 1982: Hearings on S. 777 & S. 2652 Before the Subcomm. on Environmental Pollution of the Comm. on Environment and Public Works*, 97th Cong., 2d Sess. 279 (1982) [hereinafter *Proposed 1982 CWA Amendments*].

275. *See Proposed 1982 CWA Amendments, supra* note 274.

276. *See id.* at 318–19. EPA also proposed three modifications to the variance provisions in § 316(a). First, the CWA should permit EPA to grant a thermal variance upon a showing that the discharge would cause no impairment to the water quality standards established by the states. Second, it should permit the agency to grant a variance upon a showing that a balanced population of shellfish, fish, and wildlife would remain in and on the water. Conspicuously, the word "indigenous" had been removed from before the word "population." Third, the Act should allow the state would make the determination of balanced population. *Proposed 1982 CWA Amendments, supra* note 274, at 318. However, these proposals were not adopted; Congress made no changes in the final version of the previous year's amendments. *See* Pub. L. 97-117, 95 Stat. 1623 (1981).

277. *Proposed 1982 CWA Amendments, supra* note 274, at 319.

278. S. 2652, 96th Cong., 2d Sess. § 11(b) (1982).

The testimony of EPA Deputy Administrator John Hernandez revealed that EPA perceived section 316(b)'s requirements to be too stringent.[279] According to Mr. Hernandez, section 316's "existing statutory language is very restrictive in that it authorizes only one option, best technology available, to mitigate [intake effects.]"[280] The Edison Electric Institute ("EEI") echoed this belief.[281] In fact, EEI argued that section 316(b) allowed agencies to conclude that adverse intake effects could be minimized only by means of technical modifications to location, design, construction, or capacity of intake structures.[282] EEI sought "clarification" of whether minimizing adverse impacts might also be accomplished through non-intake structure responses—"mitigation" measures—for example, fish hatcheries or stocking programs.[283] In other words, industry understood the statute to allow an agency to impose conditions indirectly requiring the use of closed-cycle cooling to minimize adverse impacts, and believed that the statute did not allow consideration of other non-intake efforts, but should do so in spite of agreement between the regulator and regulated that section 316(b) was too harsh. Despite this and even though environmental groups offered relatively mild objection to change,[284] Congress did nothing to revise section 316.[285]

While it is often perilous to attempt to discern congressional purpose from inaction,[286] here at least congressional awareness

279. *Proposed 1982 CWA Amendments*, *supra* note 274, at 114 (statement of Dr. John W. Hernandez, Jr., Deputy Administrator of EPA, on July 21, 1982).

280. *Id.*

281. *Id.* at 1168, 1196 (statement of John Gibson on behalf of EEI).

282. *Id.*

283. Minimization also might be accomplished through other mitigation measures, such as planned outages or periods of reduced power output. The Settlement Agreement reached on the Hudson River Power Plants served as precedent for this. The utility also might expect to bargain away from closed-cycle cooling by offering to include other terms in settlement agreements. For example, industry could offer to construct barrier nets, which are probably encompassed within a broad definition of "intake structure"; to improve fish return systems, which are also a component of the intake structure; and to establish biological monitoring programs, bans on future construction in the vicinity, and research endowments. *See* Hudson River Settlement Agreement (Dec. 19, 1980), *reprinted in* NEW YORK UNIV. SCH. OF LAW & NATIONAL RESOURCES DEFENSE COUNCIL, *supra* note 86, at 148–203; EPA Reg. IV, Press Release on Brunswick Nuclear Station Settlement Agreement (Oct. 6, 1980) (on file with the *Harvard Environmental Law Review*).

284. *See generally Proposed 1982 CWA Amendments*, *supra* note 274, at 224, 591, 1041 (statement of NRDC, testimony of Prof. Joseph A. Mihursky, and statement of Natural Wildlife Federation, respectively).

285. *See supra* note 276.

286. The Supreme Court addressed a similar situation in United States v. Riverside

was manifest. The Senate Committee knew from testimony that EPA considered best technology available to be something different than best available technology.[287] Congress was told that the Agency believed it could use only regulation of intake structure technology as a means of minimizing adverse impact, even though that would lead to mandating closed-cycle cooling in some cases.[288] Further, Congress knew that EPA could use section 316(b) directly to force existing sources to adopt the same "best technology available" standard required of new sources.[289]

Congressional awareness of this statutory interpretation is especially important in light of the changes that had occurred in the steam electric industry since the 1960s. Less than a third of new generating capacity added in the 1960s used closed-cycle cooling. In contrast, during the 1970s more than one half of all new electric generating capacity was added at plants using closed-cycle systems.[290] Given the long lead times associated with the construction of new generating plants, Congress easily could have discovered that in the 1980s nearly ninety percent of all new ca-

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Bayview Homes, Inc., 474 U.S. 121 (1985), in which it found guidance in Congress's failure to amend section 404 of the CWA, 33 U.S.C. § 1344 (1988):

> [W]e are chary of attributing significance to Congress' failure to act, [but] a refusal by Congress to overrule an agency's construction of legislation is at least some evidence of the reasonableness of that construction, particularly where the administrative construction has been brought to Congress' attention through legislation specifically designed to supplant it.

Riverside Bayview Homes, 474 U.S. at 137. Nonetheless, caution remains appropriate for those seeking guidance from congressional inaction.

> When one undertakes to use legislative history as a tool of statutory construction, surely the first part of wisdom is to remember that Congress is a political as well as a legislative body, and that its members will put the privileges and facilities of their respective chambers to political as well as legislative uses. Thus not every utterance to be found in committee reports or the Congressional Record may be assumed to represent statutory gold.

International Brotherhood of Elec. Workers v. NLRB, 814 F.2d 697, 715 (D.C. Cir. 1987) (Buckley, J., concurring); *see also* Wong Yang Sung v. McGrath, 339 U.S. 33, 47–48 (refusing to draw inference in favor of particular construction of an act based upon requests for legislative clarification, upon willingness of legislative committee to consider request for clarification, or upon congressional failure to enact such request), *modified on other grounds*, 339 U.S. 908 (1950).

287. *See supra* notes 276–278 and accompanying text. The difference between the two standards is unclear, however Congress treated them as separate and distinct. *Id.*

288. See *supra* notes 279–285 and accompanying text.

289. *See supra* notes 279–280 and accompanying text.

290. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 19.

pacity would use closed-cycle cooling.[291] The industry standard for new facilities had changed to closed-cycle systems since the advent of the 1972 Clean Water Act Amendments. Thus, the main issue before Congress in 1982 was whether once-through systems should be accommodated by statute for the remainder of existing plants' useful lives. Given the lofty, progressive goals of the CWA,[292] it is not surprising that Congress decided to not enact such an accommodation.

Congressional inaction, however, could be interpreted less nobly. Many, if not most, of EPA's regulatory priorities are determined from court orders or statutory amendments.[293] Congress's failure to amend section 316(b) to mandate further EPA action might be interpreted as its approval of EPA's largely inactive posture. However, given Congress's manifest awareness that EPA read section 316(b) as quite stringent, the former interpretation of Congress's maintenance of existing law is more convincing.

E. The States' Activity and Inactivity

EPA's failure to regulate under section 316(b) does not limit state regulation under state water codes or in delegated NPDES programs. In fact, states are always free to regulate more stringently than required under the federal programs.[294] Even where the CWA has not delegated authority to a state to administer the NPDES program, the state retains the authority to grant or deny certification to NPDES permits under section 401 of the Act.[295] However, on the whole, state efforts under independent or delegated authority have not filled the vacuum created by the lack of

291. *Id.* fig. 6. The trend continues into the 1990s. Based on planned capacity additions for this decade, virtually none of the new plants will use once-through cooling. *Id.*

292. *See, e.g.*, CWA § 101, 33 U.S.C. § 1251 (1988) (describing the Clean Water Act's goal of eliminating the discharge of all pollutants into U.S. waters).

293. On the role of citizen suits in invigorating EPA action under the CWA, see WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW: AIR & WATER 63–65 (1986). On the increasing complexity of legislative requirements, see WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW: AIR & WATER 1–2 (Supp. 1988).

294. *See* CWA §§ 101(b), 401(a), 402(b), 33 U.S.C. §§ 1251(b), 1341(a), 1342(b) (1988).

295. CWA § 401, 33 U.S.C. § 1341 (allowing states to "veto" NPDES permits issued by EPA).

federal cooling water intake regulations. Indeed, only one state, Maryland, appears to have a regulatory program designed to address both entrainment and impingement impacts of cooling water intake structures at point sources under section 316(b) of the Clean Water Act.[296]

Recently some states have begun to study their regulation of these structures, either at the state or plant level.[297] Other states provide some regulatory framework. For example, California, the state with the largest volume of water taken in for once-through cooling, regulates intakes using a policy statement written in 1975 and a number of section 316(b) determinations completed prior to 1980.[298] New York, second in once-through cooling water intake volume, adopted a state regulation which borrows the language of section 316(b) of the CWA, but provides no more specific regulation.[299] Upon the recent expiration of the Hudson River Power Plant Settlement Agreement, which occurred prior to the expiration of the NPDES permits for the covered facilities, New York

296. *See infra* notes 307–308 and accompanying text.

297. Delaware has commissioned an extensive study of its cooling water intake regulatory program. *See* VERSAR, INC., EVALUATION OF THE SECTION 316 STATUS OF DELAWARE FACILITIES WITH COOLING WATER DISCHARGES (April 1990) (prepared for Delaware Department of Natural Resources) (on file with the *Harvard Environmental Law Review*); *see also* N.J. REPORT, *supra* note 247. Oregon has completed a similar effort. *See* OREGON DEP'T FISH & WILDLIFE, AN INVENTORY OF WATER DIVERSIONS IN OREGON NEEDING FISH SCREENS (1990) (on file with the *Harvard Environmental Law Review*).

298. The policy statement provides that the least preferable source of cooling water consists of non-waste inland waters, and that approval of fresh inland waters for cooling use will occur only upon a "demonstrat[ion] that the use of other water supply sources or other methods of cooling would be environmentally undesirable or economically unsound." CALIFORNIA WATER RESOURCES CONTROL BD., WATER QUALITY CONTROL POLICY: USE AND DISPOSAL OF INLAND WATERS USED FOR POWERPLANT COOLING 4 (1975) (republished in 1977) (on file with the *Harvard Environmental Law Review*). The policy requires the preparation of an environmental impact statement for new cooling water use or changes in use and requires permits to include provisions for future monitoring and studies. *Id.* at 6. Although the California policy appears to be a tool that would be effective in § 316(b) regulation, it is oriented primarily to water consumption. Impingement and entrainment issues are not addressed, and most of California's § 316(b) determinations are over 10 years old. California state officials, concerned about PG&E's Pittsburg and Antioch Plants, prepared interpretive memoranda regarding § 316(b) in 1982. *See, e.g.*, Memorandum from Sheila Vassey, Staff Counsel I, Cal. Water Res. Board, to Antonia K.J. Vorster, Region 5, Cal. Water Res. Control Bd. (Feb. 16, 1982) [hereinafter Vassey Memorandum] (describing substantive and procedural requirements for conducting a section 316(a) and (b) inquiries on two PG&E plants) (on file with the *Harvard Environmental Law Review*).

299. *See* N.Y. COMP. CODES R. & REGS. tit. 6, § 704.5 (1991) (regulating "Intake Structures" with the rule that "The location, design, construction and capacity of cooling water intake structures, in connection with point source thermal discharges, shall reflect the best technology available for minimizing adverse environmental impact.").

entered into a "Letter Agreement" with the utility companies.[300] Designed to bridge the gap between settlement expiration and permit renewal, the Letter Agreement for the first time allowed the utilities to use mitigation measures as an alternative means of minimizing the adverse impacts of cooling water intakes.[301]

In four New England states, several power plant NPDES permits state that "[i]t has been determined based on engineering judgment that the circulating water intake structure presently employs the best technology available for minimizing adverse impact. *The present design shall be reviewed for conformity to regulations pursuant to Section 316(b) of the Clean Water Act when such are promulgated.*"[302] This statement indicates that, in at least one EPA regulatory region, EPA Region I, the regulators perceive an EPA responsibility to issue section 316(b) standards.

Permit conditions have not been a workable substitute for actual intake regulations. Some power plant permits issued on the Atlantic Coast contain language relating to section 316(b) issues, but few are effective. At some plants, permittees are obligated to report "unusual impingement events."[303] In others, the permitting authority has expressly reserved the right to order additional biological surveys and studies,[304] although this reservation may be unnecessary in light of the information-gathering authority already existing under section 308 of the CWA.[305] Only some of the permits contain evidence that a section 316(b) BTA determination was ever made.[306]

Maryland, the one state that provides relatively comprehensive intake regulations, requires permittees to invest in modifications designed to reduce impingement and entrainment losses.[307]

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300. *See* Letter Agreement, *supra* note 216.

301. *Id.*

302. See list of permits in Rábago, *supra* note 63, at Tab E (emphasis in original permits) (permits on file at the offices of the Hudson Riverkeeper Fund). The "engineering judgment" language stems from the "Best Professional Judgment" standard to be used pending the promulgation of standards. *See* 33 U.S.C. § 1342(a)(1)(B) (1988).

303. Rábago, *supra* note 63, at Tab E.

304. *Id.*

305. 33 U.S.C. § 1318 (1988); *see supra* note 240.

306. *See* Rábago, *supra* note 63, at Tab E.

307. The Maryland regulations provide:

> .05 Cooling Water Intake Structures
>
> A. The location, design, construction, and capacity of cooling water intake structures shall reflect the best technology available (BTA) for minimizing adverse environmental impact.

The amount that must be spent for modifications in structure or operations is based upon the number of each species destroyed by impingement, the value of the species, and a factor that weights the loss depending on whether the organisms killed are commer-

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B. The determination of BTA for minimizing adverse environmental impact shall consider the effect of:
   (1) Impingement loss as determined in § D of this regulation; and
   (2) Entrainment loss as determined in § E of this regulation.

C. Unless otherwise directed by the Department [of the Environment], cooling water intake structures withdrawing less than 10,000,000 gallons per day from surface waters are excluded from the requirements of this regulation if the volume of water is less than 20 percent of the:
   (1) Design stream flow for nontidal waters; or
   (2) Annual average net flow past the point of discharge which is available for dilution of tidal waters.

D. Determination of Impingement Loss
   (1) The value of the impingement species destroyed by the intake structure shall be determined by estimating the number of each species destroyed and multiplying by the values listed in [MD. REGS. CODE tit. 8, § 02.09.01 (1990), ranging from $1.00 per thousand for unnamed forage species to $50.00 per fish for Sturgeon]. These factors shall be weighted by multiplying by the following adjustment factor:

Species Function	Factor
(a) Recreational only	1.0
(b) Commercial and recreational	1.0
(c) Commercial only	1.0
(d) Commercial, recreational,and forage	0.8
(e) Commercial and forage	0.75
(f) Recreational and forage	0.75
(g) Forage	0.75

   (2) Dischargers shall install and operate functional modifications to mitigate impingement loss, provided that the additional cost of installation of modifications to intake structures and of operation modifications over a 5-year period does not exceed 5 times the estimated annual value of impingement loss. These approved modifications shall be defined as BTA under § B(1) of this regulation.

E. Determination of Entrainment Loss
   (1) Definition. For purposes of this regulation only, "significant" means having a statistically measurable effect beyond the mixing zone.
   (2) The discharger shall determine the extent of cooling water entrainment loss on a spawning or nursery area of consequence for [Representative Important Species] as defined in [MD. REGS. CODE tit. 26, § 08.03.04 (1990)].
   (3) If entrainment loss results in significant adverse environmental impact, the discharger shall install and operate functional modifications to mitigate entrainment loss. These approved modifications shall be defined as BTA under § B(2) of this regulation.

MD. REGS. CODE tit. 26, § 08.03.05 (1990).

cial, recreational or forage species.[308] As an effort to internalize the cost of impingement and entrainment losses, these regulations are a major step in the right direction. Whether it is ecologically sound to adopt a process that devalues the forage species on which commercial and recreational species depend is questionable. Nonetheless, the Maryland regulatory approach, as an effort to fill the regulatory void on intakes, is both laudable and, unfortunately, unique.

Relying on states to regulate intakes, however, is not only unrealistic but potentially harmful. Variations in state regulation of cooling water intakes may be problematic when several states share a single water body, because "impingement havens" may be created.[309] For example, absent effective federal oversight through regulations, cumulative upstream or downstream impacts on fish populations will likely be ignored if they occur in another state. Moreover, EPA's lack of substantive regulatory attention also gives permittees a strong argument against rigorous state enforcement.[310]

The states' failure to address the problems associated with cooling water intakes is not really surprising. Since the passage of the Clean Water Act, the states must take their cues from the EPA in the regulation of water pollution.[311] In addition, EPA regulators develop expertise and provide assistance under the programs they administer,[312] and the states look to EPA for this expertise and assistance. EPA is not regulating cooling water intakes, and it appears to not be supervising state programs in this area. The lack of sufficient state regulatory effort results in large part from EPA having taken the lead under section 316(b) and then having failed to carry through with its program.

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308. *Id.* § 08.03.05D (citing MD. REGS. CODE tit. 8, § 02.09.01).

309. Notwithstanding congressional understanding to the contrary, *see supra* note 132 and accompanying text, the possibility of site shopping exists under an increasingly competitive electric power industry, especially under relatively open transmission access. *See* ELECTRIC POWER WHEELING AND DEALING, *supra* note 30, at 30–31.

310. While the argument is premised on dubious grounds, one U.S. District Court has suggested that "it is unclear whether there is a federal policy favoring the imposition of intake requirements as a condition of a permit." Consolidated Edison Co. of New York, Inc. v. New York State Dep't of Envtl. Conservation, 726 F. Supp. 1404, 1410 (S.D.N.Y. 1989); *see supra* notes 294–306 and accompanying text.

311. CWA § 402(b), 33 U.S.C. § 1342(b) (1988).

312. *See supra* Part III.C.

IV. THE LEGAL AND POLICY JUSTIFICATIONS FOR REGULATION UNDER SECTION 316(B)

The absence of federal regulations under section 316(b) has led to both a generalized failure of states to regulate and a lack of meaningful oversight by EPA regions of state efforts. This creates the equivalent of a federal subsidy to electric power producers and others who use the nation's waters for cooling purposes in the amount of the environmental costs imposed. Section 316(b) presently requires minimization of adverse impacts. At a time when the environmental impacts of electric power generation play an increasing role in matters of energy policy,[313] it is time for EPA to regulate anew under section 316(b).

As this Part explains, there are two principal arguments that compel this conclusion. First, promulgating regulations under section 316(b) is a nondiscretionary duty of the Administrator. Second, a consistent approach to protecting aquatic organisms under the Clean Water Act and other natural resource and fish protection statutes requires regulation under section 316(b). Before addressing these issues, however, the need for and practicality of re-regulating intakes will be discussed.

A. The Possibility and Desirability of Regulation

Nondiscretionary duties that the CWA imposes upon the EPA Administrator receive special treatment under both that statute[314] and the Administrative Procedure Act.[315] The issue is not whether the Administrator is obligated to require the best technology available for cooling water intakes at point sources. That much is clearly stated in section 316(b).[316] The ultimate issue, rather, is how the Administrator should carry out that burden.

Since its first regulations were rejected by the courts, EPA has chosen to address intake impacts without formal regulations.

313. *See* PACE REPORT, *supra* note 47, at 13–48.

314. Section 505 of the CWA allows citizens to sue the Administrator when "there is alleged a failure of the Administrator to perform any act or duty under this chapter which is not discretionary with the Administrator." 33 U.S.C. § 1365(a)(2) (1988).

315. The APA empowers federal courts to "compel agency action unlawfully withheld or unreasonably delayed." 5 U.S.C. § 703 (1988).

316. 33 U.S.C. § 1326(b).

But approaching the problem without regulations has undermined the statutory best technology available requirement as a general standard.[317] And while case-by-case determination of BTA for each individual permittee is theoretically possible,[318] the existence of thousands of intake structures subject to section 316(b) renders this task too formidable to accomplish without some standardization.[319] The federal regulatory vacuum thus has weakened substantially Congress's best technology available mandate.

The absence of federal regulations also weakens state response to these concerns.[320] It leaves state regulatory agencies without formal guidance. And efforts to provide informal guidance, although laudable, would not be enforceable.[321] Under an informal approach, EPA's enforcement authority would be limited to documentary formulations of dubious authority—the same limited status the Development Document[322] and the Guidance Manual[323] hold today. It appears unimaginable that a court would uphold an EPA veto[324] of a state-issued permit based upon such guidance.[325]

317. *See supra* Part III.B.

318. For example, intake monitoring studies are a crucial component of the section 316(b) Demonstration requirement, *see supra* text accompanying notes 240–244, and an appropriate condition of any permit authorizing continued use of once-through cooling systems. Section 308 authorizes EPA to require these studies, even though § 402(a)(1) does not refer to § 316(b). *See supra* notes 207–214 and accompanying text (discussing of United States Steel v. Train, 556 F.2d 822 (7th Cir. 1977)); *see also* Inland Steel Co., Op. EPA Gen. Counsel No. 27, at Issue of Law No. 4 (Aug. 4, 1975), *reprinted in* EPAGCO, *supra* note 236, at 113, 116 (1979).

319. As discussed above, EPA has chosen to embrace a no-regulations approach and take short cuts. Regional EPA offices rely on the DEVELOPMENT DOCUMENT, *supra* note 56, and Guidance Manual, *supra* note 12, although *Appalachian Power II*, 566 F.2d 451 (4th Cir. 1977), held that requiring reference to the Development Document was illegal. *See supra* notes 195–201 and accompanying text; *see also*, Vassey Memorandum, *supra* note 298 (noting availability and nonbinding nature of Development Document and Guidance Manual). It has not been established whether reliance on those documents is permissible, because EPA has rendered BTA determinations only rarely since the early 1980s. At any rate, EPA could assert that it is using a statute-based approach and is making case-by-case determinations of BTA. Where states have been delegated NPDES authority, EPA apparently has chosen not to revisit intakes in its oversight capacity. *See* Rábago, *supra* note 63, at 12–16.

320. *See supra* Part III.E.

321. *Appalachian Power II*, 566 F.2d 451, 457 (4th Cir. 1977), explicitly held that EPA's formal § 316(b) regulations were "ineffective to impose obligations upon, or to adversely affect" the utilities because they required reference to the Development Document which was not formally promulgated. *See supra* notes 195–201 and accompanying text.

322. DEVELOPMENT DOCUMENT, *supra* note 56.

323. Guidance Manual, *supra* note 12.

324. *See* CWA § 402(d)(2), 33 U.S.C. § 1342(d)(2) (1988).

325. Of course, there is an even lower probability that EPA would veto a state permit under § 316(b) itself. Absent regulations, any such assertion of authority would be subject

Additionally, the absence of formal federal regulations requires states to develop and adopt their own regulations if they wish to obtain enforcement authority in their jurisdictions, something most states have not done.[326]

Wisely, EPA initially chose to address the adverse environmental impacts associated with cooling water intakes through formal regulation.[327] If EPA had persisted, the disadvantages of the current regulatory void could have been eliminated. Formal regulations, adopted after notice and comment procedures, are enforceable by and against state regulators. Furthermore, regulations provide a measure of certainty to permittees. Given EPA's previously expressed position that closed-cycle cooling often represents the best technology for minimizing adverse environmental impact, the individual plant's level of performance with such technology could supply the missing standard for evaluating alternative minimizing measures.[328] The prior existence of regulation, and the need for enforceability, increased certainty, and a recognizable standard suggest that formal regulation under section 316(b) is both practical and appropriate.

Additionally, formal regulation of cooling water intakes would advance three desirable purposes of the Clean Water Act. First, formal regulation would advance the goal of eliminating discharges of pollutants into U.S. waters in the most efficient manner possible.[329] Formal intake regulation would likely require the adoption of closed-cycle cooling systems,[330] which would most effectively minimize adverse environmental impacts caused by cooling intake systems. These closed-cycle systems, in turn, discharge minimal thermal pollution directly into the water.[331] Thus, this complementary form of intake and discharge control advances the statutory goal of discharge elimination.[332]

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to challenge for arbitrariness. There is no record of such an action since the regulations were remanded.

326. *See supra* Part III.E.

327. *See supra* Part III.B.1.

328. This approach also allows EPA to implement two of Congress's goals: the use of a case-by-case approach for each intake and thermal discharge structure, and an economic feasibility limitation. *See supra* notes 115–133 and accompanying text.

329. CWA § 101, 33 U.S.C. § 1251 (1988).

330. *See supra* notes 279–283 and accompanying text (describing EPA and industry recognition that section 316(b) probably required closed-cycle cooling).

331. *See supra* notes 10–11 and accompanying text.

332. In fact, regulations that maximize environmental protection by minimizing adverse impacts also improve regulatory efficiency. Such rules would reduce the need for

Second, promulgating regulatory standards under section 316(b) would facilitate the application of the most recent technical innovations for reducing adverse impacts, and would provide a framework in which to ensure continued progress toward zero discharge without "backsliding."[333] Since closed-cycle cooling systems use only two to four percent of the water required by once-through systems,[334] those systems minimize impingement and entrainment effects. Minimization of adverse impacts is the goal of the statute.[335] Therefore, even if immediate conversion of all once-through plants to closed-cycle systems would have disproportionately high economic costs, EPA at least should attempt to incrementally regulate once-through systems to closed-cycle performance levels in order to make progress toward zero discharge. In addition, requiring facilities to improve prevention and mitigation measures if they retain once-through systems would tend to narrow the economic gap between those systems and closed-cycle cooling over time and prompt earlier conversion to closed-cycle technology.[336] These same features can prevent "backsliding," which occurs two ways. A plant might replace approved technologies with less effective ones, seeking to improve a nonenvironmental aspect of intake system operation.[337] Alternatively, backsliding can occur

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§ 316(a)'s costly discharge variance procedure because reducing intakes necessarily reduces the quantity of thermal discharges. Because § 316(b)'s minimization standard is more stringent than § 316(a)'s requirement of maintaining a balance of indigenous aquatic organisms, both standards would be accommodated in a single proceeding. *See* Yost, *Science in the Courtroom*, *supra* note 35, at 299–300; Brunswick, *supra* note 250, at 27.

333. *See, e.g.*, CWA § 402(o), 33 U.S.C. § 1342(o) (1988) (permit conditions in renewed permits may not be less stringent than in previous permit); CWA § 301(c), 33 U.S.C. § 1311(c) (1988) (allowing Administrator to modify Best Available Technology requirements with respect to any point source as long as modified requirements represent maximum technology within economic capability of permittee and will result in "reasonable further progress toward the elimination of the discharge of pollutants").

334. CLARK & BROWNELL, *supra* note 3, at III-5.

335. 33 U.S.C. § 1326(b).

336. The cost to retrofit once-through systems to closed-cycle operation far exceeds the initial cost to install closed-cycle systems at the construction stage. *See* CLARK & BROWNELL, *supra* note 3, at VIII-8; Lawrence W. Barnthouse, et al., *Hudson River Settlement Agreement: Technical Rationale and Cost Considerations*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 267, 272 tbl. 87.

337. This has occurred at a few electric generating facilities in the United States. These plants replaced standard travelling screens, which have their screen faces positioned perpendicular to intake flow, with dual flow screens. Positioned parallel to intake flow, dual flow screens take water in at both the upward and downward external faces of the screen loop, channelling it to condenser pumps out of the center of loop. This system offers the advantage of eliminating debris carryover to condenser systems, but without flow-splitting modifications, produces increases in water velocity that nearly always kill juvenile fish when they impact against the screen face. Electric power industry researchers praise the

when plants working toward attainment of best technology standards fail to acquire and implement environmentally superior technologies as they become available.[338] EPA is ideally suited to prevent backsliding since it can identify the latest in minimization technology and ensure its application as permits are renewed.[339]

Third, formal regulations would improve permit compliance and enforcement. The Clean Water Act contemplates the incorporation of regulatory restrictions into NPDES permit conditions.[340] Section 316(b) requires that standards under sections 301 and 306 account for cooling water intake effects.[341] The mandates of sections 301 and 306, in turn, must be incorporated into the approval process of federal and state-delegated NPDES permit programs.[342] Therefore, by law, permits issued to facilities operating cooling water intake structures must reflect the requirements of regulations promulgated under section 316(b).

This incorporation of standards in permits produces several regulatory consequences crucial to the efficacy of the Clean Water Act programs. Permits may be revoked for noncompliance with the permit's conditions. Therefore, additional permit conditions can facilitate successful compliance monitoring and provide enforcement authority to state and federal officials.[343] The enforcement of permit conditions establishes administrative precedent, thereby enhancing regulatory efficiency, and provides a means by which interested parties can meaningfully comment on and partic-

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development of these systems. *See* EPRI, EPRI GS-6293, INTAKE TECHNOLOGIES: RESEARCH STATUS 1-4 to 1-10 tbl. 1-2 (1989).

338. Research funded in accordance with Hudson River Settlement Agreement has produced promising impingement-reducing technology at the Indian Point Power Plant in New York. *See* Hudson River Settlement Agreement 10–11 (Dec. 19, 1980), *reprinted in* NEW YORK UNIV. SCH. OF LAW & NATURAL RESOURCES DEFENSE COUNCIL, *supra* note 86, at 158–59. Dr. R. Ian Fletcher's modifications to Ristroph devices on travelling screen systems arguably constitute the best travelling screen technology available. *See* R. Ian Fletcher, *Flow Dynamics and Fish Recovery Experiments: Water Intake Systems*, 119 TRANSACTIONS AM. FISHERIES SOC'Y 393 (1990).

339. Absent national regulation, such improvements will spread slowly, if at all, outside the state where applied. Furthermore, forcing a new technology to prove its value and efficacy one state at a time will impede the application of such technology in other states.

340. CWA § 402, 33 U.S.C. § 1342.

341. 33 U.S.C. § 1326(b).

342. CWA § 402(b)(1)(A), 33 U.S.C. § 1342(b)(1)(A).

343. Section 402(a) and (b) of the CWA, 33 U.S.C. § 1342(a), (b), requires that permits issued by EPA or the states reflect compliance with standards under §§ 301 and 306 and, by extension, with the requirements of section 316(b).

ipate in efforts to maintain adherence to statutory requirements. Permit conditions and reports of compliance with those conditions facilitate enforcement efforts and enhance certainty in those efforts. Furthermore, citizens empowered to serve as "private attorneys general" may participate in the permit process, sue polluters[344] for violating standards and permits, or sue EPA for failing to perform a nondiscretionary duty.[345] Incorporating BTA standards into NPDES permits enables citizens to enforce these standards and helps to harmonize section 316(b) enforcement with the pattern found in the remainder of the CWA.

It is possible to write permit standards without the benefit of regulations. However, the approach currently in place, one without formal regulatory standards, leads to litigation. This is because only an application for judicial review of the agency decision or a jurisdictional challenge against state authority[346] can effectively test the legitimacy of conditions written into the permit. The lack of regulations also frustrates the important statutory goals of regulating discharges of pollutants with permit conditions and compliance monitoring of those permits since the regulatory void perpetuates uncertainties among permittees as to the scope and meaning of permit conditions. Permittees are thereby encouraged to use litigation, equally uncertain in outcome, to constrain regulatory discretion.

The current lack of regulation under section 316(b) exacerbates these problems for several reasons. Since few NPDES permits for facilities with cooling water intakes contain specific conditions relating to performance standards for those intakes,[347] EPA

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344. The CWA provides that:

> [P]ublic participation in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program established by the Administrator . . . shall be provided for, encouraged, and assisted by the Administrator and the States.

CWA § 101(e), 33 U.S.C. § 1251(e); *see also* CWA § 402(b)(3), 33 U.S.C. § 1342(b)(3) (stating that public must receive notice of NPDES permit applications and enjoy opportunity for public hearing); CWA § 505, 33 U.S.C. § 1365 (1988) (citizen suit provision); 40 C.F.R. § 104 (1991) (EPA regulations regarding public participation under CWA); 40 C.F.R. § 25.5 (1991) (generic EPA regulations regarding public participation).

345. CWA § 505(a)(2), 33 U.S.C. § 1365(a)(2) (1988).

346. *See supra* notes 137–146 and accompanying text.

347. *See* Rábago, *supra* note 63, at Tab E.

and the states are unlikely to be informed of intake-related environmental harm.[348] Under these circumstances, intake structures may be modified without the prior approval of regulatory authorities.[349] Additionally, uncertainty will persist among permittees about changes in permit conditions that may occur in the permit renewal process.[350] Finally, under the current scheme, citizens and regulatory enforcers possess no reliable standards upon which to initiate enforcement actions.

Federal regulatory standards must be adopted to resolve these difficulties. The promulgation of federal standards through regulation is both practical and necessary to advance the desirable objectives of the Clean Water Act.

B. Cooling Water Intake Regulation: A Nondiscretionary Duty

Discussion of the virtue of formal regulation is, to some extent, academic because Congress has mandated the promulgation of federal standards by imposing a nondiscretionary duty upon EPA to regulate cooling water intakes. In addition, by initially pursuing regulations, EPA has undertaken the obligation to address the problems of cooling water intakes.

With regard to the Congressional mandate, the language of the Clean Water Act can only be read as establishing the nondiscretionary duty. Section 316(b) requires that "[a]ny standard established pursuant to" sections 301 or 306, and "applicable to a point source shall require that the location, design, construction, and capacity of the cooling water intake structures reflect the best technology available . . . ."[351] The phrase "applicable to a point source" makes the section applicable only to sources governed under section 301,[352] thus excluding intake structures that do not

348. However, some permits contain vague exhortations to the permittee to "report unusual impingement events." *Id.*

349. There have been reports of utility initiated conversions to dual-flow screen systems in some states, undertaken without prior regulatory approval. Telephone interview with Mr. Edward W. Radle, Supervising Aquatic Biologist, New York Department of Environmental Conservation (May 5, 1992).

350. An exception is where the permittees remain confident nothing will be required by way of minimization of adverse impacts.

351. 33 U.S.C. § 1326(b).

352. CWA § 301(a), 33 U.S.C. § 1311(a) (making the discharge of pollutants illegal unless in compliance with CWA).

have an output component.[353] This is consistent with the statute's goal to eliminate discharges of pollutants into waters of the United States.[354] The section also sets out the engineering attributes of location, design, construction, and capacity for EPA to address in establishing the best technology available standard. These features are among the most likely to be associated with adverse environmental impacts.[355]

Section 316(b) operates through regulation. It is to be applied through standards adopted under sections 301 and 306 and, according to section 316(b), "shall require" the selection of the best intake technology available for minimizing and mitigating environmental harms.[356] Therefore, when EPA establishes standards under sections 301 and 306, it must address cooling water intakes, and therefore it must promulgate intake regulations under those sections.[357] Nothing in the language of the CWA suggests EPA discretion to deal with cooling water intakes in any other way.[358] Had Congress intended a case-by-case method not requiring formal regulations or standards, it would have chosen more appropriate wording.[359] Currently there is no room in the statutory language for an interpretation that EPA may simply *apply* section 301 and 306 regulations in a manner to accommodate section 316(b),[360] for

353. CWA § 301(e), 33 U.S.C. § 1311(e) (stating that effluent limitations "shall be applied to all point sources of discharge").

354. CWA § 101, 33 U.S.C. § 1251.

355. CWA § 316(b), 33 U.S.C. § 1326(b); *see* CLARK & BROWNELL, *supra* note 3, at VIII-1 to VIII-18.

356. CWA § 316(b), 33 U.S.C. 1326(b).

357. *See* CWA §§ 301, 306, 33 U.S.C. §§ 1311, 1316.

358. *But see* Association of Significantly Impacted Neighbors v. City of Livonia, 765 F. Supp. 389, 389 (E.D. Mich. 1991) (holding that plaintiff lacked standing under CWA § 505(a)(2), 33 U.S.C. § 1365(a)(2), to challenge EPA "grant decisions" because they "necessarily involve discretion and therefore are not subject to challenge in a citizens suit").

359. An alternative congressional formulation could have provided that the Administrator, or the state administering a delegated NPDES program, "shall ensure that the location, design, construction and capacity of any cooling water intake structure at a point source subject to this chapter reflect the best technology available."

360. The assertion by the EPA of a defense of impossibility or infeasibility to promulgation of the regulations is very difficult. The burden on the Agency under such claims is a heavy one. *See* Alabama Power Co. v. Costle, 636 F.2d 323 (D.C. Cir. 1980); Sierra Club v. Ruckelshaus, 602 F. Supp. 892 (N.D. Cal. 1982). EPA simply could have promulgated the 1976 cooling water intake regulations in accordance with federal "incorporation by reference" requirements. 1 C.F.R. § 51 (1992). It has been 14 years since EPA was made aware of its failure to properly promulgate the first set of regulations. *See* Natural Resources Defense Council v. Train, 510 F.2d 692, 713 (D.C. Cir. 1975) (stating that a court must "separate justifications grounded in the purposes of the [statute] from footdragging efforts of a delinquent agency").

Congress specifically indicated that the regulatory standards themselves were to be the vehicle for this task.[361] The statute plainly makes regulation under section 316(b) a nondiscretionary duty of the Administrator.[362]

EPA practices in the 1970s constitute the second reason that the CWA must be read as compelling formal regulations under section 316(b). Even if the Administrator had some discretion in choosing how to implement section 316(b), once EPA chose to promulgate formal regulations, the Administrator had a mandatory duty to do so correctly.[363] Since the individual states have failed to regulate cooling water intakes,[364] and since several states still issue permits to electric generating facilities stating that cooling water intakes will be addressed when EPA issues regulations, it is even more necessary that EPA fulfill this obligation. Even though EPA recognized the importance of the national uniformity that is obtainable only through formal regulations,[365] EPA has never explained why it failed to re-issue section 316(b) regulations in spite of many opportunities to do so.[366]

In addition to the plain language of the statute, then, EPA's past actions and statements call for the issuance of regulations under section 316(b). In other words, it is unreasonable to continue "nonregulation" in light of prior commitments to a regulatory program and the expectations created by such a program. Whether

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361. *See, e.g.*, 33 U.S.C. § 1316(b)(1)(B); *see also* Virginia Electric Power Co. v. Costle, 566 F.2d 446 (4th Cir. 1977). It is not necessary for EPA to write § 316(b) regulations for every category of point sources. Creating generic regulations to be applied on a case-by-case basis is a sensible way to account for the fact that not every point source, or even every point source within a category, will utilize a cooling water intake. *See supra* notes 160–179 and accompanying text.

362. Further evidence of Congressional intent to make this nondiscretionary is provided in that an action against the Administrator for failure to regulate would be initiated under CWA § 505(a)(2), 33 U.S.C. § 1365, and would lie in mandamus. To obtain a writ of mandamus under the federal mandamus statute, 28 U.S.C. § 1361 (1988), the plaintiff must allege that the defendant had the duty to perform a "specific, plain, ministerial act, 'devoid of the exercise of judgment or discretion.'" J.E. Brenneman Co. v. Schramm, 473 F.Supp. 1316, 1318–19 (E.D. Pa. 1979) (citing Commonwealth of Pa. v. Nat'l Ass'n of Flood Insurers, 520 F.2d 11, 25–26 (3d Cir. 1975)). An act is ministerial "only when its performance is positively commanded and so plainly prescribed as to be free from doubt." *Schramm*, 473 F. Supp. at 1319.

363. *See* Golden Gate Audubon Soc'y v. U.S. Army Corps of Engineers, 700 F. Supp. 1549, 1554 (N.D. Cal. 1988) (holding that once effort was made to regulate, the Corps of Engineers had "mandatory duty to ascertain the relevant facts, correctly construe the applicable statutes and regulations, and properly apply the facts to the law").

364. *See supra* Part III.E.

365. *See supra* notes 160–174 and accompanying text.

366. *See supra* note 262.

the absence of regulations is consistent with other statutory schemes similarly enacted for the protection of aquatic organisms is the final question to be resolved.

C. Conformity of the Current Regulatory Approach with Other Statutes

Statutory recognition of the adverse effects of cooling water intake structures reinforces the view that the harms associated with the operation of power plants and other sources should be remedied or compensated for by those sources. Indeed, section 316(b) compels regulation that would force the electric power industry to bear the cost of implementing technologies to reduce those harms. The question, then, is whether an interpretation of section 316(b) requiring EPA to formally regulate cooling water intakes is consistent with other Congressional pronouncements concerning fish protection.[367] Since other statutory schemes provide protection where EPA's current practice under section 316(b) does not, the issue narrows to whether EPA's practice is consistent with the tenor of a variety of congressional policies. A brief review of three categories of such policies reveals that EPA's failure to regulate under section 316(b) conflicts with Congress's explicit environmental program and thus that EPA must promulgate formal regulations under section 316(b) for intake requirements to be consistent with relevant federal law.

1. Fish and Wildlife Protection Statutes

The states and the federal government both possess the authority to regulate human activity that may affect fish adversely.[368] At the state level, fish and game laws, generally enforced through permit or license provisions, establish limitations upon private and commercial takings of fish. The states enjoy broad authority, both under their police powers and as public trustees, to regulate the taking of fish, and may provide civil, criminal, and *in rem* forfeiture

367. *See generally*, MICHAEL J. BEAN, THE EVOLUTION OF NATIONAL WILDLIFE LAW (1983).

368. Of course, where state regulation implicates interstate commerce issues, it might be voided. *See* Hughes v. Oklahoma, 441 U.S. 322, 338 (1979).

penalties for violations of their fish and game laws.[369] Prohibited conduct includes taking certain species, taking fish with improper equipment, taking fish out of season, taking improperly sized fish, or placing obstructions in waters.[370] Generally, fish and game laws create a strict liability, even for criminal penalties.[371] Commercial violations or knowing violations generally receive more serious penalties or are treated as felonies.[372]

Some states, however, have had some difficulty allocating resources for the enforcement of fish and game laws. As early as 1900, the federal government lent assistance with the passage of the Lacey Act.[373] As currently configured, the statute broadens the effect of the state laws by converting any violation of a state law designed to protect fish or wildlife into a federal offense.[374] The Act prohibits the importation, export, transport, sale, receipt, acquisition, or purchase in commerce of any species "taken, possessed, transported or sold in violation" of a state's wildlife protection laws.[375] Liability under the statute may be civil,[376] criminal[377] or *in rem*.[378] In criminal cases, felonies require knowledge of a violation of the underlying state statute, while misdemeanors may rest upon a showing that the violator, in the exercise of due care, should have known that the act violated the law.[379]

There is further evidence of Congress's concern for fish and wildlife. In 1934, Congress recognized "the vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors."[380] Congress therefore sought "to provide that

369. *See generally* Lawton v. Steele, 152 U.S. 133 (1894) (holding that states possess the power to regulate the taking of fish).

370. *See generally* 35 AM. JUR. 2D *Fish & Game* §§ 43–51 (1967 & Supp. 1992).

371. *Id.* § 52.

372. *See, e.g.*, TEX. PARKS & WILD. CODE ANN. §§ 61.901, 66.2011–66.2013 (West 1991).

373. 16 U.S.C. §§ 3371–3378 (1988).

374. The Act was designed to lend federal enforcement assistance to state laws protecting wildlife. S. REP. No. 123, 97th Cong., 1st Sess. 2 (1981), *reprinted in* 1981 U.S.C.C.A.N. 1749.

375. 16 U.S.C. § 3372.

376. *Id.* § 3373(a) (civil penalties); *id.* § 3373(e) (permit suspension or revocation).

377. *Id.* § 3373(d).

378. *Id.* § 3374.

379. *Id.* § 3373(d).

380. *See* 16 U.S.C. § 661 (1988).

wildlife conservation shall receive equal consideration"[381] by enacting the Fish and Wildlife Coordination Act.[382]

Under the 1958 amendments to this Act,[383] whenever a federal agency or other entity operating under federal permit or license seeks to impound or divert any waters of the United States, it first must consult with the Fish and Wildlife Service ("FWS") of the Department of the Interior and with state officials, "with a view to the conservation of wildlife resources by preventing loss of and damage to such resources as well as providing for the development and improvement thereof. . . ."[384] The Fish and Wildlife Coordination Act thus requires a federal agency to consider adverse environmental impacts[385] and the possibility of mitigating environmental costs[386] in its decisionmaking process. The issue left unaddressed by the Fish and Wildlife Coordination Act is the degree to which loss or damage to wildlife must be controlled. The Clean Water Act's section 316(b) supplies that standard in the context of cooling water intakes—controls are to be implemented to the

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381. *Id.*

382. *Id.* §§ 661–662 (1988).

383. Fish & Wildlife Coordination Act, Pub. L. No. 85-624, § 2, 72 Stat. 563, 564 (1958) (codified as amended at 16 U.S.C. §§ 661–666).

384. 16 U.S.C. § 662(a). The permitting of power plant intake structures for once-through cooling systems triggers the Fish and Wildlife Coordination Act's consultation requirement. In order to provide its biologists with guidance for consultation, the FWS established a National Power Plant Team within the Biological Services Program. This program produced a number of Topical Briefs relating to power plant siting and impingement and entrainment losses. *See, e.g.*, R.R. BOWLES ET AL., FACTORS AFFECTING ACCURACY OF ICHTHYOPLANKTON SAMPLES USED IN POWER PLANT ENTRAINMENT STUDIES (1978); EUGENE S. FRITZ, COOLING WATER INTAKE SCREENING DEVICES USED TO REDUCE ENTRAINMENT AND IMPINGEMENT (1980) [hereinafter FRITZ, SCREENING DEVICES]; EUGENE S. FRITZ, FEDERAL WATER POLLUTION CONTROL ACT: THE SECTIONS 316(A) AND (B) PROCESS (1978) [hereinafter FRITZ, SECTIONS 316(A) AND (B)]; C. PHILLIP GOODYEAR & BETH L. FODOR, ECOLOGICAL IMPLICATIONS OF ANTICIPATED ELECTRIC POWER DEVELOPMENT (1977).

385. As the Senate Report accompanying the 1958 amendments to the Coordination Act indicated,

> The Fish and Wildlife Service would make known to these construction agencies, such as the Corps of Engineers and the Bureau of Reclamation, the project necessary to protect fish and wildlife. Considerable study would be required in some cases, with suggested changes in construction plans to the great advantage of our wildlife resource.

S. REP. No. 1981, 85th Cong., 2d Sess. 1 (1958), *reprinted in* 1958 U.S.C.C.A.N. 3446, 3446.

386. S. REP. No. 1981, 85th Cong., 2d Sess. 4 (1958), *reprinted in* 1958 U.S.C.C.A.N. 3446, 3449.

extent that the best technology available can minimize adverse environmental impacts.[387]

The Magnuson Fishery Conservation and Management Act[388] provides a third example of federal concern for the protection of fish. The Magnuson Act establishes a comprehensive program regulating fisheries[389] located along the United States coast between the outer coastal edge of state fisheries authority and the two hundred mile exclusive economic zone.[390] Under the Act, Regional Fishery Management Councils develop fishery management plans[391] to implement the statutory mandates.[392] These plans may include permit requirements, fishing zone and season limits, catch limitations based on areas, species, size, number, weight, and other factors, limitations on gear and equipment types, and other limitations.[393] To enforce these conditions, the Magnuson Act imposes civil penalties of up to $25,000 per violation, and provides for permit suspension or revocation.[394] In addition, violations may lead to forfeiture of vessels, gear, and catch.[395] The statute imposes criminal penalties for violations by foreign fishers and for willful false reporting or obstruction of enforcement by domestic fishers.[396] In all, the Magnuson Fishery Management and Conservation Act demonstrates a significant commitment on the part of Congress to the regulation and conservation of fisheries. This commitment demonstrates the inconsistency of EPA policy under section 316(b) of the Clean Water Act with overall government policy for the protection of aquatic species.

The taking of fish by cooling water intakes does not exploit fisheries resources in a beneficial manner, but rather inflicts undesired costs associated primarily with obtaining electric power. Consequently, impingement and entrainment losses frustrate the goals of state and federal fishery conservation and regulation.

387. CWA § 316(b), 33 U.S.C. § 1326(b).

388. 16 U.S.C. §§ 1801–1882 (1988) *as amended by* 16 U.S.C.A. §§ 1801–1882 (West Supp. 1992). The Act was originally entitled the Fishery Conservation and Management Act of 1976, and was amended in 1980 to its present title. Pub. L. No. 96-561, tit. II, § 238, 94 Stat. 3275, 3301 (1980).

389. 16 U.S.C.A. § 1801(a)(6).

390. *Id.* § 1811(a).

391. *Id.* § 1852(h)(1).

392. *Id.* § 1852(a).

393. *Id.* § 1853(b).

394. *Id.* § 1858(a).

395. *Id.* § 1860(a).

396. *Id.* §§ 1857(1), (2), 1859.

Indeed, if EPA were to hold industrial sources governed by section 316(b) of the Clean Water Act accountable for fish "taken" by cooling water intake structures under state fish and game statutes, or for taking fish without a permit under the Magnuson Fishery Management and Conservation Act, few once-through systems would operate today. This Article does not argue that mortalities inflicted by power plants should be included in fishery harvesting allocations.[397] However, the analogy of fish "takings" supports the regulation of intake-related harm as a necessary means of making the application of section 316(b) consistent with broad Congressional purposes of fish protection.

2. Natural Resource Damages Under CERCLA and OPA

In the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA")[398] and the Oil Pollution Act of 1990 ("OPA"),[399] Congress created additional liability schemes for fish kills that indirectly result from human activities. Under these statutes, those who cause natural resource damages either through the release of hazardous substances or oil face strict liability for the damages. CERCLA section 107 makes covered persons strictly liable to natural resource trustees for "damages for injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing such injury, destruction, or loss resulting from" a release of a hazardous substance.[400] The OPA provides for similar liability for losses resulting from oil spills.[401]

Congress has indicated, then, that some types of incidental taking of aquatic organisms, as loss or damage to natural resources, makes the actor strictly liable. Like the fish protection statutes discussed above, this regime also stands in contrast to that under the current regulatory scheme of section 316(b): though

397. The New York Department of Environmental Conservation has expressly rejected such an approach. The sound New York position recognizes that the allowances for beneficial takings should not include fishery impacts from cooling water even though those impacts occur in the course of producing some net social benefit. *See* Letter from Thomas C. Jorling, Commissioner, New York Department of Environmental Conservation, to Eugene R. McGrath, Chief Executive Officer, Consolidated Edison, New York, New York (Apr. 29, 1991) (on file with the *Harvard Environmental Law Review*).

398. 42 U.S.C. §§ 9601–9675 (1988).

399. 33 U.S.C.A. §§ 2701–2719 (West Supp. 1992).

400. CERCLA § 107(a), (f), 42 U.S.C. § 9607(a)(4)(C) (1988).

401. 33 U.S.C.A. § 2706.

it is illegal to kill fish with hazardous waste or oil spills, the same fish may be killed by a cooling water intake structure with regulatory impunity.

It is no defense of this distinction to say that electricity, or other products of facilities with cooling water intakes, are socially beneficial. Both the oil and chemical industries produce similarly useful products. It is the incidental and unintended harm associated with the operation of all of these industries that the environmental statutes are designed to regulate. Congress's standards for addressing the intakes' adverse impacts on aquatic life merit regulatory attention equal to that accorded undesired releases of oil or hazardous materials. In fact, notions of regulatory efficiency suggest that the enormous, chronic losses associated with cooling water intake structures should be addressed before the sporadic losses caused by oil spills and hazardous waste releases. At the very least, however, Congress's statutory prohibitions against fish kills by means of hazardous releases and oil spills suggest that EPA's regulatory abdication regarding the mandates of section 316(b) is inconsistent with the overall federal policy of fish protection.

3. Environmental Crimes Liability

One final example of congressional concern for regulating environmental damage like that associated with cooling water intake structures is found in the treatment of such effects in the criminal enforcement context. When first handing down federal indictments with respect to the infamous Exxon Valdez oil spill, the government charged Exxon with two felony and three misdemeanor violations of environmental and shipping safety statutes.[402] Remarkably, the government announced a possible criminal penalty in the range of $700 million.[403]

A new criminal sentencing provision in the Criminal Fines Improvement Act of 1987[404] made such a large penalty possible.

402. *See Exxon Would Be Liable for Double Fines If Department of Justice Motion Prevails*, 21 Env't Rep. (BNA) 1980, 1980 (Mar. 8, 1991); *Federal Grand Jury Indicts Exxon After Alaska Rejects Proposed Plea*, 20 Env't Rep. (BNA) 1811, 1811 (Mar. 2, 1990).

403. *See Federal Grand Jury Indicts Exxon After Alaska Rejects Proposed Plea*, *supra* note 402, at 1812.

404. Pub. L. No. 100-185, 101 Stat. 1280 (1987) (codified at 18 U.S.C. § 3571(d) (1988)).

The statute authorizes fines in the amount of twice the loss caused by the offense as an alternative to usual criminal penalties, which are capped at $250,000 for individuals, or $500,000 for organizations.[405] The language of this Act places no limit on fines for environmental crimes or natural resource damage cases. The validity of prosecutions for environmental damages under the Criminal Fines Improvement Act was confirmed when the court accepted the settlement agreement in the Exxon Valdez case that included a criminal penalty of more than $100 million, an amount far in excess of previously permissible fines.[406]

Thus, under the Act, any criminal violation of environmental laws that produces natural resource damage may subject the violator to enormous fines of up to twice the cost of the environmental loss.[407] Under the current regime, criminal enforcement is an option under virtually every federal environmental statute.[408] And in many cases, violators are strictly liable for misdemeanor violations under an extension of the public welfare offense doctrine.[409] The applicability of this doctrine to natural resource losses like those associated with intakes suggests the inconsistency of the current unregulated state of cooling water intakes and the general congressional mandate for environmental protection.

In summary, Congress has, on many occasions over a number of decades, demonstrated a desire to protect aquatic organisms from undue predation by human activity. EPA's failure to regulate under section 316(b) means that fish kills caused by cooling water intakes receive different treatment than kills committed in other ways. If fish are killed in violation of a state licence, in violation of a federal fishing permit, by oil or hazardous substances, or as a result of an environmental crime, the responsible party faces liablility equal to the value of that loss or more. If the same party

405. 18 U.S.C. § 3571(b)–(d).

406. *Judge Accepts Exxon Pact, Ending Suits on Valdez Spill*, N.Y. TIMES, Oct. 8, 1991, at A14.

407. 18 U.S.C. § 3571(d).

408. *See, e.g.*, Federal Insecticide, Fungicide and Rodenticide Act § 14(b), 7 U.S.C. § 1361(b) (1988); Toxic Substances Control Act § 16(b), 15 U.S.C. § 2615(b) (1988); Endangered Species Act § 11(b), 16 U.S.C. § 1540(b) (1988); Surface Mining Control and Reclamation Act § 518(e), 30 U.S.C. § 1268(e) (1988); CWA § 309(c), 33 U.S.C. § 1319(c) (1988); Clean Air Act § 113, 42 U.S.C.A. § 7413(c) (West Supp. 1992); Resource Conservation and Recovery Act § 3008(d), 42 U.S.C. § 6928(d) (1988).

409. *See* United States v. Park, 421 U.S. 658 (1975); United States v. Dotterweich, 320 U.S. 277 (1943) (holding that corporations and corporate officers can be held criminally liable without specific intent for certain offenses that risk the public health or welfare).

kills the same fish by means of an intake screen, virtually no regulation or liability exists.

This differing treatment results in significant danger to the ecosystems which fish inhabit. Since the organisms most seriously affected by cooling water intake structures are usually juvenile fish, too young and small to escape intake currents, or planktonic larvae and embryo, these organisms die before having an opportunity to reproduce. Combined with already high natural mortality rates, impingement and entrainment losses pose a very serious threat to population maintenance.[410]

The firm goals of the comprehensive scheme of federal regulation include the protection and enhancement of aquatic ecosystems and valuable fisheries stocks. EPA's failure to regulate under section 316(b) constitutes the weak link in the chain, standing in marked and unacceptable contrast to the totality of federal natural resource protection statutes.

V. A Proposal for Cooling Water Intake Regulations

To solve the problems discussed above, EPA should carry out its existing statutory mandate to regulate cooling water intakes under section 316(b) of the Clean Water Act. The regulatory development and promulgation process, by aiding state efforts, by revealing and promoting the most advanced technology possible, and by focusing on sources still using once-through systems, will compel the Agency to address meaningfully the problems of impingement and entrainment effects, and will ensure the earliest possible completion of the electric power industry's transition from once-through to closed-cycle cooling systems. Regulations protecting fish and other aquatic organisms from the incremental mortalities attributable to intake systems will ensure that electric power plants will not cause depletion in surrounding waters and that they will be in compliance with other federal and state laws. Several features of the regulations EPA should promulgate are outlined below.

As a first step in promulgating regulations, EPA should conduct a technological review of cooling water intake structures and other devices available to mitigate the adverse environmental im-

410. *See supra* note 77 and accompanying text.

pacts of intake systems. This process could begin with the Development Document,[411] although a number of its technical assumptions need revision.[412] The new development document must incorporate the significant technological developments that have occurred since the time of the original Development Document. For example, some large systems now use passive intake screens that allow fish to avoid impingement and entrainment.[413] Also, modifications to traditional vertical screen systems have enhanced capabilities that help return fish to the environment unharmed.[414]

Additionally, some state research in the field could provide useful data for the new development document. A closed-end research and technology review period, lasting no longer than one year, should provide sufficient review of available technologies and allow the collection of a full cycle of seasonal data. The analysis should use the most sophisticated analytical methodologies currently available, including empirical transport models and conditional mortality determination methodologies. These methodologies will create a uniform standard of measurement that will provide the basis for performance-based regulations under section 316(b). The final analysis should thus produce a development document that considers the major issues, identifies the most reliable analytical methodologies, and describes the most effective mitigation technologies.

With a new development document, the Agency could establish a regulatory process for determining the proper BTA and setting appropriate limitations.[415] Consistent with prior congressional determinations underlying section 316(b), the prescription of a specific technology for every intake is unnecessary.[416] None-

411. DEVELOPMENT DOCUMENT, *supra* note 56.

412. For example, the Development Document discusses the fish diverting function of "resultant velocities" operating across the faces of louvers, *id.* at 51–55, and angled screen systems, *id.* at 82–88, where these velocities simply do not exist. *See* R. IAN FLETCHER, A SURVEY AND ANALYSIS OF FISH CONSERVATION DEVICES FOR WATER-PUMPING FACILITIES HAVING HIGH VOLUMETRIC RATES OF INTAKE A-2 to A-27 (Hudson River Foundation Report No. 1, 1984).

413. Passive intakes use very low intake velocities. They ensure adequate intake volume with a large array of devices in a tree-like configuration. Typically they are placed at depths that minimize pelagic (open water) and benthic (sea or lake bottom) effects. *See* Fournier, *supra* note 87.

414. *See* Fletcher, *supra* note 338, at 413–15 tbls. 5, 6.

415. For a helpful schematic diagram of the process under § 316(b), as perceived by the Fish and Wildlife Service, *see* FRITZ, SECTIONS 316(A) AND (B), *supra* note 384, at figs. 1–5.

416. *See supra* notes 129–133 and accompanying text.

theless, the performance associated with closed-cycle systems should properly form the baseline for regulatory analysis and determinations.

In the regulatory analysis and determination process, it would be unnecessary for the EPA to marry consideration of economic concerns with environmental ones under section 316(b). As discussed previously, Congress said precious little when enacting the section. Although one legislator did suggest an implicit economic limitation on BTA,[417] little legislative history addresses this concern.[418] However, when Congress wanted economic factors to inform technological limits, it made clear statements to that effect in the language of the Clean Water Act.[419] Thus the absence of such language in section 316(b) carries significant weight.[420]

Nonetheless, some combination of economic and biological analysis must drive the new regulatory process under section 316(b) toward the goal of one hundred percent closed-cycle or equivalent systems at major water cooled facilities. Fortunately, the absence of past regulations has not stymied all research and development of mitigation technology. Some exciting progress has been made in reducing impingement on intake screens.[421] Of course, some readjustment period is to be expected while power companies and other large intake sources acquire and encourage the development of capable teams of analysts. Some organizations have kept abreast of the issues, but they may lack the capacity to immediately service the nation-wide demand that would accompany federal regulation.[422] Regulatory agencies in several states retain sufficient institutional resources to apply the new standards with relatively short lead times. In all, the efforts redirected toward modelling and analysis of biological and economic impacts would take some time to bear fruit, although past experiences already

417. *See supra* text accompanying note 156.

418. *See supra* Part III.A.

419. *See, e.g.*, 33 U.S.C. § 1311(c); *id.* § 1314(b)(1)(B); *id.* § 1316(b)(1)(B).

420. *See In re* Public Service Co. of New Hampshire, 10 Env't Rep. Cas. (BNA) 1257, 1260–61 (E.P.A. 1977) (holding that Congress's silence on issue of cost/benefit analysis indicated intent to disregard economic considerations in section 316(b) determinations) (U.S. Environmental Protection Agency permit hearing).

421. *See generally* Fletcher, *supra* note 338.

422. It has been more than 15 years since the EPA's § 316(b) regulations were invalidated by the court in *Appalachian Power II*, 545 F.2d 1351, discussed *supra* notes 195–201, and, therefore, 15 years since anything resembling a "nation-wide" program addressing cooling water intakes existed.

provide the necessary building blocks. The extensive work done in the 1970s may, in some cases, form a sufficient starting point.

In addition to the direct benefit of added fish protection, much of the work done to comply with the new regulatory scheme would aid other regulatory efforts. Empirical Transport Models, designed to predict potential losses at cooling water intakes, could provide valuable information about a host of other environmental impacts.[423] For example, they would assist in evaluating the costs and benefits of consumptive withdrawals.[424] As the EPA Science Advisory Board has recently counselled,[425] strong scientific reasons justify improving the quality of understanding about ecosystems. Grounding regulatory efforts on that such understanding yields a significant environmental benefit.[426]

Finally, it should be noted that designing effective fish protection systems can be indirectly profitable. Fish consumption will probably increase with population, and since screening system improvements are essential to ensure protection of aquatic organisms, there should be a continuing market for protective systems that work.

The Agency should consider designing the new regulations to provide smaller cooling water systems with a limited exemption or a relaxed implementation schedule, where the intake does not have a "disproportionately high" environmental impact. Exemptions on an individual basis would be appropriate as long as the regulations include a variance clause which would alert the operators of small volume facilities to potential regulatory relief. The system enacted should only provide for exemptions of finite length and should actively prohibit backsliding by any regulated entity. In addition, the regulatory process should favor extending implementation times over granting indefinite exemptions. The best way in which to alleviate regulatory impact on small volume facilities may be to expand the range of deviation for those intakes.

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423. This information could be used not only to evaluate the effects of consumptive and nonconsumptive withdrawals but also to inform estimates of environmental damage caused by oil and chemical releases into water and of the damage associated with construction and development in and around waters.

424. These models could be used to derive externality costs associated with consumptive withdrawals. This information might demonstrate that water conservation programs yield improved benefits.

425. *See* REDUCING RISK, *supra* note 48, at 9, 17, 25.

426. *Id.*

Lastly, utility companies undertaking outages, or reductions in power output, to meet the new regulations should not be allowed to use the resulting reductions in revenues as a basis for delay in implementing BTA. Such delays should only be tolerated when the Agency has determined that immediate BTA implementation would create wholly disproportionate economic impacts on the company. Regulators must keep in mind the statutory goal of "minimization" and not settle for reduction to a preset amount of environmental protection.[427]

The BTA regulatory protocol should reflect some version of the following eight steps:

1. Establish closed-cycle performance.
2. Establish the performance variance range.
3. Set the BTA performance level.
4. Review proposed and potential technology mixes to accomplish performance level.
5. Determine economic feasibility of immediate implementation.
6. Establish alternate interim performance standards.
7. Set alternate implementation timetable.
8. Establish biological monitoring and reporting requirements.

The first step, establishing closed-cycle performance, is the heart of the proposed regulatory process. Section 316(b) requires the cooling water intake structure's location, design, construction, and capacity to reflect the best technology available for minimizing adverse environmental impacts.[428] Closed-cycle systems, which use from two to four percent of the water required by comparable once-through systems at the same plants,[429] most effectively address capacity,[430] the crucial component. Minimizing this component automatically addresses the construction, design, and location factors by vastly reducing the quantity of water needed. Therefore, a closed-cycle system would represent the starting point for determining the best technology available for minimizing impacts associated with the statutory factors.

427. *See In Re* Public Service Co. of New Hampshire, 10 Env't Rep. Cas. (BNA), 1257, 1260–61 (E.P.A. 1977); Brunswick, *supra* note 250 at 27–32.

428. CWA § 316(b), 33 U.S.C. § 1326(b).

429. CLARK & BROWNELL, *supra* note 3, at III-5.

430. Under the statute, "capacity" means "volume". *See In Re* Public Service of New Hampshire, 10 Envt'l Rep. Cas. (BNA) 1257, 1262 (E.P.A. 1977).

As part of establishing closed-cycle cooling performance, the permit-granting agency should determine the theoretical performance of the plant, new or existing,[431] with a closed-cycle cooling system in place. Using models and biological assessment methods approved in a development document, the utility should be required to demonstrate to the relevant agency's[432] satisfaction the effect of the intake system on the environment. The final report should address both quantitative and qualitative effects. To ease the process of gathering data, the agency should allow a focus on representative important species.[433] Quantitative data should include estimated numbers of organisms lost to the closed-cycle system. Qualitative discussions should identify special concerns, such as highly affected populations and endangered or threatened species. The final report should detail the impact associated with closed-cycle cooling. Determining this closed-cycle performance level will, after some adjustment for a performance variance range, enable the agency to set a BTA standard for the plant.[434]

The second step, establishing a performance variance range, stems from the first. The models that extrapolate collected data into predicted effects[435] also yield a margin of error. The relevant agency must approve a degree of deviation from the closed-cycle performance level to account for this potential error.[436]

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431. Congress failed to enact amendments creating separate standards for new and existing sources under § 316(b). *See supra* Part III.D.

432. The relevant agency is the federal or state permit issuing authority under CWA § 402, 33 U.S.C. § 1342.

433. Representative important species are a select group of species identified for regulatory attention. Such a limitation is essential in order to avoid entrainment estimation from becoming unduly burdensome. This approach has been adopted in Maryland. *See supra* note 307.

434. A simple example illustrates. Assume the models predict that a closed-cycle system would impinge and kill 200 perch per year, plus or minus 10. The appropriate level of closed-cycle performance should be set at not more than 200 perch per year.

435. *See* Lawrence W. Barnthouse & Webster Van Winkle, *Analysis of Impingement Impacts on Hudson River Fish Populations*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 182; John Boreman & C. Phillip Goodyear, *Estimates of Entrainment Mortality for Striped Bass and Other Fish Species Inhabiting the Hudson River Estuary*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 152; Sigurd W. Christensen & Thomas L. Englert, *Historical Development of Entrainment Models for Hudson River Striped Bass*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 133; Mark T. Mattson, et al., *Reliability of Impingement Sampling Designs: An Example from the Indian Point Station*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 161.

436. The performance variance range for the example discussed in note 434 should be set at 10 fish per year.

The third step of a well-designed regulatory scheme would be to set the BTA performance level for the individual source. The effects associated with closed-cycle systems, adjusted for potential modelling error, translate into a performance standard for the facility which must receive agency approval. This standard should consist of specific mortality levels for representative important species and ultimately should become part of the facility permit.[437] When the performance standard and reporting requirements are included in the permit, more effective enforcement is possible, including citizen enforcement under section 505.[438]

After identifying a performance standard, as a fourth step the facility must determine which specific technologies will be used to accomplish the BTA performance level. A facility with a cooling water intake structure cannot, consistent with current interpretation of section 316(b), simply be commanded to use a particular type of cooling system.[439] Therefore, the permittee enjoys the discretion to choose the system. For once-through systems that do not attain BTA performance levels, the facility should have the choice of retrofitting to closed-cycle systems or otherwise modifying the existing cooling system to achieve compliance. Nevertheless, this step imposes a burden upon the facility to demonstrate to the relevant agency that its cooling system, however modified, meets the BTA standard. Variance from this standard, other than that addressed in step two above, would only be allowed under situations detailed in step five.

Although costs are not mentioned in section 316(b),[440] a limited amount of legislative history[441] and EPA practice[442] has imposed a limit upon what can be asked of point sources using cooling water intake structures. EPA has not required modifications when their economic cost would be wholly disproportionate to the resultant environmental benefits.[443] Therefore, as a fifth step, the relevant

437. Continuing the example from *supra* note 434, the BTA performance standard for the facility would be set at 210 perch. This represents the maximum losses of perch permitted in a year during the permit term.

438. *See* CWA § 505(a)(1), 33 U.S.C. § 1365(a)(1). Reflecting standards in the permit also contributes to resolution of the problems of lack of enforceability and enforcement. *See supra* notes 347–350 and accompanying text.

439. *See supra* note 241.

440. CWA § 316(b), 33 U.S.C. § 1326(b).

441. *See supra* note 156 and accompanying text.

442. Pilgrim Nuclear Station, *supra* note 245, at 15.

443. *Id.*

agency should review the economic cost of implementation of BTA. If the agency determines that BTA costs are not wholly disproportionate, the technology mix identified in step four should be implemented through permit conditions. For these facilities, steps six and seven may be skipped. On the other hand, if costs are disproportionate, the agency and the facility should proceed to step six.

Step six requires alternate interim performance standards when the facility cannot immediately begin to implement BTA because the agency has found the economic costs to be wholly disproportionate to the environmental benefits. Alternate standards short of BTA should be developed, identifying specific technologies[444] or operations adjustments[445] appropriate to reduce adverse environmental impacts to the maximum extent possible. To prevent abuse, these alternate standards should have a limited lifetime of no more than the remaining permit life plus five years.[446] In addition to the implementation of alternate technologies and operations strategies, the permit should require the facility to fund an account that would enable it to implement BTA standards of performance at the end of the interim period. This latter step would ensure that implementing alternate standards does not become an excuse for economic inability to comply at the end of the variance period.

Furthermore, during this interim period, the facility should make reasonable progress toward attaining BTA standards.[447] Reasonable progress would be ensured, in step seven, through an agency-approved timetable for implementing alternate technologies and operations strategies. The timetable should require the facility to employ increasingly stringent controls designed to make progress toward achieving BTA performance levels. As section

444. For example, as part of the Hudson River Settlement Agreement, the Bowline Plant installed a barrier net. *See* J.B. Hutchison & J.A. Matousek, *Evaluation of a Barrier Net Used to Mitigate Fish Impingement at a Hudson River Power Plant Intake*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 280.

445. For instance, as part of the Hudson River Settlement Agreement, Indian Point agreed to periods of reduced operations in order to minimize intake losses. *See* Thomas L. Englert et al., *Plant Flow Reductions and Outages as Mitigative Measures*, *in* SCIENCE, LAW, AND HUDSON RIVER POWER PLANTS, *supra* note 32, at 274.

446. Thus, this total could never exceed 10 years because permit life is a maximum five years under CWA § 402(B)(1)(b), (a)(3), 33 U.S.C. § 1342(B)(1)(b), (a)(3), and is similar to the limited period of protection afforded under CWA § 316(c), 33 U.S.C. § 1326(c).

447. "Reasonable further progress" is derived from the variance provision in CWA § 301(c), 33 U.S.C. § 1311(c).

316(b) does not provide for any variance from the BTA standard,[448] this requirement is consistent with EPA and industry understanding of the rigor of the BTA standard.[449]

Consistent with step six, the timetable for implementing alternate interim standards should be limited to the remaining permit life plus five years. It should prevent the transition to BTA standards of performance from creating a disproportionate economic burden on the facility.

The eighth and last step of the recommended protocol is the development of biological monitoring and reporting requirements for the facility. This should be done whether the facility is implementing alternate interim standards or BTA standards. These requirements, like those for pollutants permitted under the National Pollution Discharge Elimination System,[450] would provide valuable information for enforcement purposes, as well as a basis for reviewing cumulative impacts upon ecosystems. The relevant agency should develop a standard monitoring and sampling regime designed to provide national uniformity in data collection. Final regulations should allow for more stringent monitoring and reporting requirements when a facility is located near an ecosystem of special environmental concern.

This eight-step model provides a workable and beneficial regulatory blueprint for carrying out the mandate of section 316(b). Regardless of the ultimate details of any EPA section 316(b) regulations, however, those regulations must create a process that implements the statutory BTA standard. While recognition of economic realities is appropriate, financial sensitivities should not be permitted to derail progress toward Congress's unambiguous, mandatory best technology standard. Regulators must bear in mind that although environmental impacts associated with cooling water intakes may be a byproduct of a socially desirable activity, they are in themselves undesirable and long since ripe for adequate regulation.

448. CWA § 316(b), 33 U.S.C. § 1326(b).

449. *See supra* notes 280–282 and accompanying text.

450. CWA § 402, 33 U.S.C. § 1342; *see* 40 C.F.R. § 122.41 (1992) (listing conditions applicable to all permits).

VI. CONCLUSION

Congress may not have fully appreciated the potential import of its actions when it enacted the conference substitute for section 316. Likewise, Congress may not fully appreciate what it has done by leaving the section unamended for the past twenty years. Nonetheless, Congress adopted an appropriate statutory response to the problems of cooling water intakes.

The steam electric industry has accomplished a remarkable transition in the last twenty years, as nearly all the new power plants built in this country have been built with closed-cycle units.[451] In fact, EPA's inattention to the shorcomings of existing intake systems may have made it easier for the utility companies to accomplish this transition by enabling them to avoid costly retrofitting of environmentally damaging once-through systems built in decades past. However, now is the appropriate time to terminate the environmental subsidy to existing, harmful cooling water intakes.

Sound environmental regulation is necessary during the remaining useful life of power plants with once-through systems still in operation. EPA can realistically develop enforceable regulations, and a good deal of the administrative law developed in the 1970s can be used as a guideline for their preparation. EPA must, as Congress mandated, turn its attention to regulating this legislatively proscribed ecosystemic harm and reject the false dichotomy of environment against economics. The congressionally appointed guardian of aquatic ecosystems impacted by cooling water intakes has dozed long enough.

451. 1991 ENVIRONMENTAL DIRECTORY, *supra* note 1, at 15.