

TULANE ENVIRONMENTAL LAW JOURNAL

VOLUME 14

WINTER 2000

ISSUE 1

Mixing Zones: Diluting Pollution Under the Clean Water Act

Gershon Eliezer Cohen*

I.	INTRODUCTION	2
II.	100 YEARS OF FEDERAL WATER POLLUTION CONTROL.....	2
	<i>A. Water Pollution Protection Prior to 1972</i>	4
	<i>B. The Clean Water Act</i>	10
	<i>C. The 1977 Amendments to the Clean Water Act</i>	14
	<i>D. The Water Quality Act of 1987</i>	15
III.	MIXING ZONES	17
	<i>A. Mixing Zones Defined</i>	17
	<i>B. Mixing Zones and Federal Regulation</i>	24
	<i>C. Mixing Zones and Federal Criteria</i>	30
	<i>D. Mixing Zones and Federal Guidance/Technical Support</i>	34
IV.	MIXING ZONES IN ALASKA	40
	<i>A. Alaska Law</i>	40
	<i>B. Alaska Mixing Zone Regulations</i>	41
	<i>C. Alaska Mixing Zone Applications</i>	48
	<i>D. Alyeska Ballast Water Treatment Facility</i>	49
	<i>E. Greens Creek Lead-Zinc Mine</i>	51
	<i>F. Alaska Placer Miner General Permit</i>	54
	<i>G. Cook Inlet General Permit for Oil Drilling</i>	56
V.	MIXING ZONE ADJUDICATION	62
	<i>A. Ford Motor Co. v. EPA</i>	62
	<i>B. Hercules, Inc. v. EPA</i>	65

* Dr. Gershon Cohen is the National Director of the Campaign to Safeguard America's Waters, a project of the Earth Island Institute which addresses the application of mixing zones to the discharge of toxic pollutants. Dr. Cohen holds a M.A. in Molecular Biology from the University of California at Riverside and a Ph.D. in Environmental Policy from Columbia Pacific University.

C. *Marathon Oil Co. v. EPA*..... 68
 D. *Ackels v. EPA*..... 71
 E. *Puerto Rico Sun Oil Co. v. EPA* 71
 F. *American Iron and Steel Institute v. EPA*..... 72
 G. *Red Dog Mine Mixing Zone Proposal* 74
 VI. CONCLUSION 79

I. INTRODUCTION

The following Article examines the evolution and implementation of a specific aspect of United States water pollution management: the authorization and use of “mixing zones.” Mixing zones are volumes of water within public waterbodies immediately adjacent to wastewater discharge outfalls permitted to have pollution levels that exceed otherwise binding state water quality standards.¹

Mixing zone policies are state-drafted water quality-based effluent limitation mechanisms. This Article will demonstrate that the Clean Water Act may not necessarily support the authorization of mixing zones that remove beneficial uses from portions of public waters, as they are currently applied across the United States.² Relevant portions of federal and state laws, regulations, criteria, technical support documents, and significant case law are also discussed. Furthermore, the evolution of the Alaska mixing zone regulation is reviewed to compare a state mixing zone policy with federal regulation and guidance. Finally, recommendations are offered for revision of federal and state mixing zone rules that would lead to greater consistency between the goals and provisions of the Clean Water Act and the regulations and policies adopted by state and federal governing bodies for their implementation.

II. 100 YEARS OF FEDERAL WATER POLLUTION CONTROL

Clean water is an essential natural resource. Throughout history, societies have thrived or failed on the basis of their ability to control the import of fresh water for drinking, food production and hygiene, and the export of water once it has been employed for waste assimilation and transport. As population densities have increased, local waters have been called upon to absorb more and more

1. EPA, WATER QUALITY STANDARDS HANDBOOK, SECOND EDITION at GLOSS-4-5 (EPA-828-B-94-005A, 1993).
 2. See Clean Water Act, 33 U.S.C. §§ 1251-1387 (1994).

pollution. Some of the world's greatest civilizations, founded on successful efforts to secure clean water for drinking and irrigation, collapsed in part due to their inability to escape the downstream effects of their own pollution.³

Public waters are jointly administered in the United States by federal, tribal, state, and territorial governments.⁴ The focus of these overlapping authorities has shifted in the past century as issues of allocation and navigability have been supplanted by concerns over the control of pollution and other broader issues of ecosystem protection. The various uses served by public water supplies are dependent upon one another. Once seemingly inexhaustible supplies of clean water are now recognized to be finite, fragile, and in many locations, in significant jeopardy.⁵

This awareness has increased the impetus to enact laws and adopt regulations capable of addressing the complexity and importance of water quality protection. A vision of these needs and expectations was articulated in the opening sentence of our nation's primary water pollution law, the Clean Water Act, which states, "The objective of this chapter is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."⁶ The 1972 Clean Water Act (CWA) established that by the year 1985, there should be a complete elimination of the discharge of pollutants into waters of the United States.⁷ The admirable goals and objectives articulated in the CWA have, however, been subject to the push and pull of politics. Although significant progress has been made, the zero-discharge goal has not yet been achieved.

Fundamental definitions concerning the acceptable limits of waste disposal in public waters continue to be debated. Federal regulations still permit the release of pollutants at levels that exceed concentrations necessary to enjoy various uses in public waters, as long as the discharges are sufficiently limited to not preclude the attainment of those beneficial uses in the overall waterbody.⁸ One such type of pollution allowance, authorized under federal regulation as the "mixing zone," is routinely permitted in every geopolitical region of the country.⁹ Despite popular support for protecting,

3. See JAMES PERRY & ELIZABETH VANDERKLEIN, *WATER QUALITY: MANAGEMENT OF A NATURAL RESOURCE* 31 (1996).

4. See *Water Quality Standards*, 40 C.F.R. § 131.1 (2000).

5. See 33 U.S.C. § 1251(a).

6. *Id.*

7. *Id.* § 1251(a)(1).

8. See 40 C.F.R. § 131.12(2) (2000).

9. See *id.* § 131.13.

maintaining, and improving the quality of the nation's waters, given current technological limits and the nation's economic priorities, it is safe to assume that United States waters will continue to be utilized to assimilate polluted wastes for some time to come.

A. Water Pollution Protection Prior to 1972

The first significant water pollution law in the United States was the Rivers and Harbors Appropriation Act of 1899, also known as the Refuse Act.¹⁰ The primary concern of the Refuse Act was the protection of interstate navigation and commerce.¹¹ Under the Refuse Act liquid wastes were routinely dumped into public waters as long as pollution levels did not impede or obstruct navigation.¹²

In the 1960s the scope of the Refuse Act was broadened by several Supreme Court decisions to more generally prohibit the discharge of industrial wastes into public waters.¹³ Pollution control was to be achieved through a permit system focused on the establishment of technology-based effluent limitations.¹⁴ Although never extensively applied, the Refuse Act's permitting program was enjoined in 1971 and not resurrected by the time of the passage of the CWA in 1972.¹⁵

Congress passed the Federal Water Pollution Control Act (FWPCA) in 1948, affirming that waste disposal was a legitimate use of the nation's waters.¹⁶ Water pollution management under the 1948 FWPCA departed from the Refuse Act in two significant ways. First, responsibility for the control of pollutants was acknowledged to lie primarily with the states.¹⁷ Second, states had to demonstrate that a pollution event resulted in some requisite level of harm in interstate waters to merit the application of an abatement action.¹⁸

To secure an abatement action under the FWPCA, the downstream state had to fulfill a tortuous list of bureaucratic requirements. The victim state had to identify the pollution event, prove the culpability of the polluter, demonstrate that the pollution endangered the health or welfare of persons in the state, and convince

10. See Rivers and Harbors Appropriation Act of 1899, ch. 425, 30 Stat. 1121.

11. See *id.*

12. See John P.C. Fogarty, *A Short History of Federal Water Pollution Control Law*, CLEAN WATER DESKBOOK 3, 7 (1988).

13. LAW OF ENVIRONMENTAL PROTECTION 12-6.1 (Sheldon M. Novick et al. eds., 2000).

14. See Fogarty, *supra* note 12, at 8-9.

15. See *id.* at 9.

16. See Water Pollution Control Act, Pub. L. No. 80-845, 62 Stat. 1155, § 5(a) (1948).

17. Fogarty, *supra* note 12, at 7.

18. See *id.*

the governor of the state in which the pollution originated to undertake an abatement action.¹⁹ Even after those steps were successfully completed, the remedial administrative process was so cumbersome that not a single abatement action was enforced in over two decades.²⁰

The FWPCA remains the primary water pollution law in the United States having been significantly amended a total of six times, most recently in 1987.²¹ As noted above, early versions of the FWPCA permitted the polluting of public waters unless it was proven that the action endangered the public's health or welfare.²² By the mid-1960s it was apparent that every state needed to establish minimum standards of water quality and that federal law could no longer support the assumption that virtually any level of pollution was tolerable depending upon the ability of an adjacent state to prove a downstream impact.

The first significant change in the FWPCA appeared in the third set of amendments with the passage of the Water Quality Act of 1965,²³ which required states to adopt "water quality standards" to assess and control the impacts of intrastate pollution on interstate waters.²⁴ The use and sophistication of water quality standards regulations has evolved markedly over the past several decades. The following description of the water quality standard-setting process is based on their current development and application under federal law and regulation.

Water quality standards (WQS) define the water quality goals for a waterbody on the basis of two components. First, one or more uses are designated for a waterbody.²⁵ Second, pollutant-specific criteria are established as necessary to protect the designated use or uses.²⁶ Water uses are generally characterized as either "designated" uses or "existing" uses. A "designated use" is a specified use for a particular segment of a waterbody as stated in a water quality standard, which may or may not be presently attainable.²⁷ Every discharge from a

19. See S. REP. NO. 92-414 at 5 (1971), *reprinted in* 1972 U.S.C.C.A.N. 3668, 3672.

20. See *id.*

21. Fogarty, *supra* note 12, at 12-13.

22. See Water Pollution Control Act, Pub. L. No. 80-845, 62 Stat. 1155 (1948).

23. See Water Quality Act of 1965, Pub. L. 89-234, 79 Stat. 903 (1966).

24. S. REP. NO. 92-414 at 2, *reprinted in* 1972 U.S.C.C.A.N. at 3669.

25. Some examples are: Public Water Supply, Fish and Wildlife Propagation, Recreation, Industrial Processes, or Navigation. 33 U.S.C. § 1252(a) (1994).

26. For example, mass limits, concentrations, or conditions. Water Quality Standards, 40 C.F.R. § 131.11(a) (2000).

27. See EPA, INTRODUCTION TO WATER QUALITY STANDARDS 5 (EPA-23-B-95-004 1994).

facility into a public waterbody must adhere to treatment protocols that will lead to the attainment of the water's designated uses.²⁸ The term "existing uses" is defined as "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards."²⁹ Designated uses of a waterbody can be removed, while existing uses cannot.³⁰ The distinction between designated uses and existing uses is significant because once a use has been attained it becomes an existing use, and the water quality necessary to support it must be maintained.³¹

The addition or deletion of a designated use from a waterbody by a state must be accompanied by a Use Attainability Analysis (UAA) to determine the water's attainable uses.³² The EPA describes a UAA as "a structured scientific assessment of the physical, chemical, biological, and economic factors that affect the attainment of a use."³³ The UAA enables the state to determine the existing levels of water quality, pollution, and pollution controls sufficient to ensure that a use may become or remain attainable.³⁴ Any attainable use is thereafter recognized as an existing use, and becomes a designated use of the waterbody.³⁵ The public must be given the opportunity to comment on proposed use changes, which must be subsequently approved by the Environmental Protection Agency (EPA).³⁶

Once uses are designated for a waterbody, pollution limits or "criteria" are established on a pollutant-by-pollutant basis to ensure that the use or uses can be met.³⁷ When a waterbody has more than one designated use the criteria necessary to protect the most stringent use are applied.³⁸ The term "criteria" has two definitions under the CWA. Under section 304, the EPA publishes scientifically-derived information "on the concentrations of specific chemicals . . . that [will] protect aquatic life [and] human health."³⁹ These specific limits

28. *Id.*

29. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, GLOSS-4 (citation omitted).

30. EPA, INTRODUCTION TO WATER QUALITY STANDARDS, *supra* note 27, at 5.

31. *See id.*

32. *Id.* at 7.

33. *Id.*

34. *See id.*

35. Water Quality Standards, 40 C.F.R. § 131.10(i) (2000).

36. *Id.* §§ 131.20(b), 131.21.

37. *See* 40 C.F.R. § 131.11(a)(1).

38. *Id.*

39. EPA, INTRODUCTION TO WATER QUALITY STANDARDS, *supra* note 27, at 9.

are provided as guidance to the states and are not legally enforceable.⁴⁰

Under section 303 of the CWA the term criteria is used to denote elements of formally adopted WQS, by which states intend to provide the water quality necessary to protect a given use. The EPA's 1994 *WQS Handbook* defines criteria as "elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use."⁴¹ In this latter definition criteria are legally enforceable.⁴² Federal water quality regulations adopted pursuant to the CWA specify in the subsection entitled *Criteria* that, "[s]tates must adopt those water quality criteria that protect the designated use."⁴³

There are two fundamental forms of criteria: "numeric" and "narrative." Numeric criteria are conditions or concentrations of pollutants that do not preclude the protection of designated uses. They are commonly represented in parts/million or micrograms/liter of the pollutant in the water column.⁴⁴ Numeric criteria designed to protect aquatic life are developed through aquatic toxicology studies that analyze the chronic and acute impacts to sensitive organisms after exposure to a range of pollutant concentrations.⁴⁵ Human health numeric criteria are commonly developed through extrapolation of epidemiological studies. Depending upon the nature of the pollutant, numeric criteria developed to protect human health may consider parameters such as a pollutant's potential to "bioconcentrate" (concentration in the body of a compound absorbed from water) or "bioaccumulate" (concentration in the body of a compound absorbed from water and food).⁴⁶

Narrative criteria are nonnumeric statements used to define restrictions on polluted discharges with the intent of protecting designated uses.⁴⁷ Narrative criteria are typically expressed as concise statements about the level of protection to be maintained in a given waterbody.⁴⁸ For example, "[a]ll waters . . . , including those within mixing zones, shall be free from substances, attributable to wastewater discharges or other pollutant sources, that . . . [c]ause

40. *See id.*

41. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, GLOSS-3.

42. *See* 40 C.F.R. § 131.4(a).

43. *Id.* § 131.11.

44. *See* EPA, INTRODUCTION TO WATER QUALITY STANDARDS, *supra* note 27, at 9.

45. *See* EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 3-24.

46. *Id.* at 5-8.

47. *Id.*

48. *See id.*

injury to, or are toxic to, or produce adverse physiological responses in humans, animals, or plants.”⁴⁹ Narrative criteria are often referred to as “free-from” statements, such as free from floating debris, oil sheen, or objectionable odor. Narrative criteria are typically related to the CWA’s goal that all waters of the United States be free from toxic amounts of toxic pollutants.⁵⁰ As stated in the EPA *Water Quality Handbook*, “the narrative criteria apply to all designated uses at all flows and are necessary to meet the statutory requirements of section 303(c)(2)(A) of the CWA.”⁵¹

States may modify numeric and narrative criteria on a site-specific basis to reflect environmental conditions at a particular site. Such modified criteria are known as site-specific criteria.⁵² Drafting

49. Water Quality Standards for the Colville Indian Reservation in the State of Washington, 54 FED. REG. 28,622, 28,627 (July 6, 1989).

50. See EPA, INTRODUCTION TO WATER QUALITY STANDARDS, *supra* note 27, at 10.

51. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 3-24.

52. Narrative and numeric criteria come in several forms:

(1) “Human health criteria” provide guidelines that specify the potential risk of adverse effects to humans due to substances in the water. Human health criteria are typically derived to protect against long-term (chronic) health effects. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 3-24. These criteria are established on the assumption that the majority of the risk results from the consumption of aquatic organisms that have absorbed toxic pollutants. When data is available, other case-specific factors are sometimes considered, e.g., the type of fish consumed, the type of fish tissue consumed, the tissue’s lipid content, consumption rates and patterns, and food preparation practices. See EPA TECHNICAL SUPPORT DOCUMENT FOR WATER QUALITY-BASED TOXICS CONTROL 37 (EPA/505-2-90-001, MAR. 1991). In general, human health criteria are based on national statistics and consumption surveys, and assume that humans consume 6.5 grams of contaminated organisms daily, and that the average body weight of a human is 70 kilograms. EPA, INTRODUCTION TO WATER QUALITY STANDARDS, *supra* note 27, at 12-13. Concerns have been raised that these criteria may significantly underestimate the risks of high-end seafood consumers and minimize other potential exposure pathways placing children, pregnant women, and the elderly at an inappropriately greater risk. As a result, the human health criteria risk assumptions are now being reviewed by state and federal water quality managers.

(2) “Aquatic life criteria” are designed to protect all plant and animal aquatic life. Two types of aquatic life criteria are generally established: “acute” and “chronic.” “EPA [typically] derives acute criteria from 48-96 hour tests for lethality or immobilization,” although the agency has recently recognized that the commonly applied 96-hour lethality endpoint used in toxicity testing is not conservative for measuring acute toxicity. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 3-3; see also 40 C.F.R. § 131.38(c)(2)(v) (2000). Acute criteria are also referred to as the “Criteria Maximum Concentration” (CMC), defined as the EPA’s “recommendation for the highest instream concentration of a toxicant or an effluent” that will not cause an acute effect after a brief exposure. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at GLOSS-3.

“EPA derives chronic criteria from longer-term (often greater than 28-day) tests that measure survival, growth, reproduction,” or in some cases bioconcentration. *Id.* at 3-3. Chronic criteria are also referred to as the “Criteria Continuous Concentration” (CCC), defined as the “EPA’s recommendation for the highest instream concentration

objective water quality criteria is not a simple task. The first federal water quality standards handbook, authored by scientists from the National Academy of Sciences and known as the *Green Book*, clearly recognized the challenge.⁵³ The panel's commissioner summed up the effort by many of the nation's premier aquatic biologists and chemists of the time in the *Green Book's* letter of transmittal by stating, "[t]he work of the Committee illuminates the fact that the unknowns still far exceed the knowns in water quality requirements—even to the experts."⁵⁴ Commentators have more recently described the broader challenges involved in developing water quality standards.⁵⁵ Oliver Houck notes that the task begins with an analysis of the chronic and/or acute nature of the discharged substances, their persistence, and bioaccumulative and synergistic potential to humans and the organisms utilizing the receiving water.⁵⁶ This analysis is intrinsically linked to the consumption and recreation patterns of people using the waterbody, the seasonal variations in aquatic life, and to potential impacts of the discharged substances as they move through the food chain.⁵⁷ The analysis must be related to the specific characteristics of the waterbody, such as the seasonal flow rates, background concentrations of similar substances or potentially interactive chemicals, and other factors such as oxygen levels, sediment composition, temperature, and turbidity as appropriate.⁵⁸ Numerical modeling with consideration for potential synergistic and additive effects is then conducted to determine if and when water quality criteria might be exceeded.⁵⁹ Numerical concentration limits and narrative criteria should be developed for every parameter of the discharge to ensure that water quality criteria are met.⁶⁰ Finally,

of a toxicant or an effluent" that will not cause an unacceptable effect with indefinite exposure. *Id.* at GLOSS-3.

(3) "Biological criteria" are just beginning to be employed by a few states to control pollution on the basis of the desired biological conditions for various types of aquatic communities. *See id.* at 13-14.

(4) "Sediment criteria," still under development by the EPA and select states, would address the accumulation of toxins in animal tissues by controlling the allowable levels of pollutants in sediments. *See id.*

53. *See* NAT'L TECH. ADVISORY COMM. TO THE SEC'Y OF THE INTERIOR, WATER QUALITY CRITERIA (1968).

54. *Id.* at i.

55. *See* Oliver A. Houck, *The Regulation of Toxic Pollutants Under the Clean Water Act*, 21 ENVTL. L. REV. 10,528, 10,545 (1991).

56. *Id.* at 10,544-45.

57. *See id.* at 10,545.

58. *See id.*

59. *See id.*

60. *See id.*

physical, chemical and biological monitoring systems capable of tracking the results of the discharge *in situ* must exist and be practicable for the discharger to employ.⁶¹

In summary, WQS consist of established uses and the criteria adopted to protect them. Under the 1965 FWPCA amendments, WQS were expected to fulfill two roles. First, they operated as the measure of performance, establishing the maximum level of pollution allowable in interstate waters.⁶² Second, they provided an avenue of legal action against polluters.⁶³ In 1966 further amendments were made to the FWPCA requiring dischargers to report the quantities and types of pollutants released.⁶⁴ Despite these repeated adjustments to the 1948 FWPCA, Congress concluded that more radical actions were required to reverse the declining status of the nation's waters.⁶⁵ Also, Congress recognized the imprecision inherent in water quality models and the difficulty of using these models to establish effluent limits, as required under the 1965 amendments.⁶⁶ As a result, a major shift in the permitting and enforcement mechanisms of the FWPCA were proposed and adopted by Congress in 1972.⁶⁷

B. *The Clean Water Act*

Now a generation old, the 1972 amendments to the FWPCA marked a radical reorientation of federal water pollution law and remain a remarkable effort to make public waters cleaner and safer. Originally known as the Federal Water Pollution Control Act Amendments of 1972, the title of the revised FWPCA was shortened in 1977 to what we now refer to as the Clean Water Act (CWA).⁶⁸ The CWA is composed of six subchapters that cover the following topics: research, grants for construction of sewage treatment works, standards and enforcement, permits and licenses, general administrative provisions, and state water pollution control revolving funds.

61. See S. REP. NO. 92-414 at 4 (1971), reprinted in 1972 U.S.C.C.A.N. 3668, 3676.

62. See *id.*

63. See *id.*

64. See Clean Water Restoration Act of 1966, Pub. L. No. 89-753, 80 Stat. 1246, § 208(b).

65. See Fogarty, *supra* note 12, at 8.

66. See S. REP. NO. 92-414 at 4, reprinted in 1972 U.S.C.C.A.N. at 3675.

67. See *id.*

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

Expanding upon the vision statement of the CWA cited earlier,⁶⁹ Congress established a number of other policies and goals.⁷⁰

One of the most fundamental changes brought by the passage of the CWA was the explicit reversal of the 1948 FWPCA premise that the ability to discharge polluted waste streams was a legitimate use of the nation's waters.⁷¹ Section 301 of the CWA clearly delineated the federal government's new perspective that, "[e]xcept as in compliance with this section . . . , the discharge of any pollutant by any person shall be unlawful."⁷² Congress fully acknowledged that state-controlled actions under the FWPCA structured on water quality based control mechanisms had failed to reverse the deteriorating quality of the nation's waters, thus requiring an increase in federal control over the issue of water pollution.⁷³ A cornerstone of the 1972 amendments was the creation of a permitting system for the discharges of wastes into waters of the U.S. based primarily on the effluent limitations approach established under the Refuse Act.⁷⁴

The Clean Water Act's discharge-permitting program, the National Pollution Discharge Elimination System (NPDES),⁷⁵ combined the effluent limitation approach of the Refuse Act with the water quality standards program of the 1965 FWPCA. The task of overseeing this permitting program fell to the EPA.⁷⁶ Implementation of the NPDES program is described in federal regulation.⁷⁷ As its name implies, the NPDES was designed to control and reduce the release of pollutants into public waters, eventually eliminating altogether the discharge of wastes into the waters of the United States. Pollution permits under the NPDES program are administered directly

69. Clean Water Act, 33 U.S.C. § 1251(a) (1994).

70. The policies and goals include: (1) the elimination of the discharge of pollutants into navigable waters by the year 1985; (2) that wherever attainable, national waters should support the propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water by 1983; (3) a prohibition against the discharge of toxic pollutants in toxic amounts; (4) a program of financial assistance to provide for the construction of publicly owned waste treatment works; (5) the development of area-wide waste treatment management planning processes to help control sources of pollutants in each state; (6) the undertaking of national research and demonstration efforts to develop technologies that would lead to the elimination of the discharge of wastes into public waters; and (7) the development of programs to control nonpoint source pollution as well as point source pollution. See 33 U.S.C. § 1251(a).

71. See Water Quality Standards, 40 C.F.R. § 131.10(a) (2000).

72. 33 U.S.C. § 1311(a).

73. See S. REP. NO. 92-414 at 4 (1971), reprinted in 1972 U.S.C.C.A.N. 3668, 3675.

74. See Khristine Hall, *The Control of Toxic Pollutants Under the Federal Water Pollution Control Act Amendments of 1972*, 63 IOWA L. REV. 609, 612 (1978).

75. 33 U.S.C. § 1342.

76. *Id.* § 1251(d). EPA was assigned general responsibility for national water pollution control after its creation in 1971, a duty previously held by the Department of Interior.

77. See Water Quality Standards, 40 C.F.R. § 122 (2000).

by the EPA, or by states, tribes, or territories that have demonstrated to the federal government the capacity to adequately implement the NPDES permitting program.⁷⁸ At this time, forty-four states and a number of territorial and tribal governments are delegated authority over the NPDES permitting program within their boundaries.⁷⁹ The EPA continues to draft NPDES permits in those states that have not been delegated authority over the program.

The NPDES program combines the application of two distinct, yet overlapping methods of control for water pollution. The federal effluent guidelines program is the primary enforcement mechanism, imposing limitations reflecting technologically and economically feasible industry-wide controls.⁸⁰ These technology-based standards focus on the treatment that a pollutant receives prior to discharge, rather than the effect the pollutant has on the receiving water.⁸¹ To facilitate the transition from the pre-1972 FWPCA ambient water quality program to the incorporation of technology-based pretreatment controls, Congress authorized the EPA to require limits for existing point sources based on Best Practicable Control Technology (BPT).⁸² The CWA required that effluent limitations were to be adopted by 1977 that would lead to the meeting of applicable state or federal WQS.⁸³

To further incorporate technology-based controls into the permitting process, section 306 of the CWA required the EPA to evaluate twenty-seven major industrial categories and establish the Best Available Technologies Economically Achievable (BAT) that could be applied industry-wide. Industry-wide BAT controls, known as New Source Performance Standards (NSPS) must be applied to new point sources.⁸⁴ By 1983, older facilities regulated by BPT were required to upgrade their pollution control systems to BAT. This “ratcheting down” of permissible pollution was intended to move the country closer to the zero discharge goal of the CWA.⁸⁵

Congress also required the EPA to develop a list of toxic pollutants by 1977 and to describe each pollutant’s toxicity,

78. See State Program Requirements, 40 C.F.R. § 123.1 (2000).

79. See Telephone Conversation with Barbara McCleod, Special Assistant to the Administrator, EPA, Office of Water (Aug. 11, 1999) (on file with author).

80. See Mark Van Putten & Bradley Jackson, *The Dilution of the Clean Water Act*, 19 U. MICH. J. L. REFORM 863, 873 (1986).

81. See *id.*

82. Clean Water Act, 33 U.S.C. § 1314(b)(1)(A) (1994).

83. *Id.* § 1311 (b)(1)(A).

84. *Id.* § 1316.

85. See Fogarty, *supra* note 12, at 12-13.

persistence, degradability, presence, and impact on potentially affected organisms.⁸⁶ For these pollutants, BAT controls would automatically apply.⁸⁷ An important premise of the CWA's effluent guidelines program is that technology-based limits are set on an industry-wide basis. Section 301 of the CWA states that "effluent limitations for categories and classes of point sources . . . shall require the application of the best available technology economically achievable for such category or class, which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants."⁸⁸ Technology-based limits are applied at the point of discharge, and are commonly described as "end of pipe" limits.⁸⁹ When there are no established technology-based limits for a pollutant, Best Professional Judgment (BPJ) technology limits are imposed.⁹⁰

State WQS play a supplemental role to the technology-based effluent limitations program under the CWA.⁹¹ WQS must be translated into effluent limits and applied in NPDES discharge permits when they will result in the application of a more protective effluent limitation than a corresponding technology-based effluent limitation.⁹² The relative roles of the technology-based and water quality-based limitations programs as compared to the direct use of WQS as a means of pollution control are described in the CWA's legislative history, which states that "[u]nder this Act the basis of pollution prevention and elimination will be the application of effluent limitations. Water quality will be a measure of program effectiveness and performance, not a means of elimination and enforcement."⁹³

The shift in use of WQS as a control mechanism from the FWPCA to the CWA was not merely hierarchical. As previously noted, under the earlier FWPCA, in which WQS were the means of enforcement, actions against dischargers were evaluated with consideration of individual costs to determine "reasonable" levels of pollution. Under the CWA, WQS are used to develop effluent limitations that do not incorporate individual costs for compliance;

86. 33 U.S.C. § 1317(a)(1)

87. *Id.* § 1317(a)(2).

88. *Id.* § 1311(b)(2)(A).

89. Fogarty, *supra* note 12, at 13.

90. *See id.*

91. *See Hall, supra* note 74, at 632.

92. *See id.* at 633.

93. S. REP. NO. 92-414 at 4 (1971), *reprinted in* 1972 U.S.C.C.A.N. 3668, 3676.

one is either violating the standard or one is not.⁹⁴ In order to facilitate adequate protection under the NPDES program, section 303 of the CWA requires that states, tribes, and territories publicly review and modify their WQS and the implementation procedures for the application of those WQS at least once every three years.⁹⁵ These triennial reviews must be submitted to the federal government for approval to ensure that the state's WQS program continues to serve the purposes of the CWA.⁹⁶

Finally, under section 401 of the CWA, states without delegated authority over the NPDES permitting process are given one year to certify that EPA-drafted permits are consistent with all applicable state WQS regulations.⁹⁷ If the state fails to certify a permit in one year, the EPA may then issue the NPDES permit. During the section 401 certification process states have the opportunity to incorporate water quality-based variances and site-specific requirements that might not otherwise be available to the applicant under a strict interpretation of the federally controlled, technology-based effluent limitations program.

C. *The 1977 Amendments to the Clean Water Act*

In 1977, the CWA was adjusted with what have become known as the "mid-course corrections,"⁹⁸ which have been described as "constituent group reactions against objectionable policies" in the 1972 Act.⁹⁹ Deadlines for compliance with various provisions of the effluent guidelines program were moved back and gaps in the regulatory scheme were filled.¹⁰⁰ One of the 1977 CWA's adjustments reorganized pollutants into three categories: conventional pollutants, toxic pollutants, and nonconventional pollutants, to be controlled

94. Fogarty described the inherent conflict between these two approaches by which society might choose to control pollution. Briefly, he posits that the ambient WQS control system of the 1948 FWPCA assumed that water was essentially a free resource; abatement judgments were only to be forwarded if physically and economically practicable for the discharger. Conversely, the effluent standards (either technology-based or water quality-based) approach incorporated from the Refuse Act does not depend upon reasonableness; the permissibility of a discharge is evaluated on whether the discharge is acceptable or unacceptable. The effluent limitations program under the Act controls pollution at its source, assuming that there are always costs. The burden and costs of control are placed on the discharger without direct concern for the economic impacts on an individual facility or the physical impacts to any specific portion of a waterbody. See Fogarty, *supra* note 12, at 9.

95. Clean Water Act, 33 U.S.C. § 1313(c)(1) (1994).

96. See *id.* § 1313(c)(2)(A).

97. *Id.* § 1341(a)(1).

98. See Clean Water Act of 1977, Pub. L. No. 95-217, 91 Stat. 1566.

99. WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW 255 (2d ed. 1994).

100. See Fogarty, *supra* note 12, at 12-13.

individually under the NPDES permitting system.¹⁰¹ The conventional pollutants are regulated under the standard Best Conventional Pollution Control Technology (BCT) that considers the “reasonableness of the relationship between the costs of attaining a reduction in effluents and the effluent reduction benefits derived.”¹⁰²

A second category, “toxic pollutants,” regulated under section 307 of the CWA, includes those substances that singly or in combination could “cause death, disease . . . , genetic mutations, physiological malfunctions or physical deformations, in such organisms or their offspring.”¹⁰³ The third category, “non-conventional pollutants,” was adopted to cover all pollutants not listed as either toxic pollutants or conventional pollutants, and is controlled by the BAT limitations under section 301.¹⁰⁴

D. The Water Quality Act of 1987

The Water Quality Act of 1987 incorporated another set of revisions into the FWPCA, the most significant of which addressed the management of toxic discharges.¹⁰⁵ Congress recognized that deadlines for achieving BAT controls were still lacking for many dischargers, in part due to the EPA’s delay in promulgating effluent guidelines for specific industries. In response, Congress moved the BAT deadlines back to 1989.¹⁰⁶

Section 301 of the CWA was amended to allow BAT modifications for nonconventional pollutants such as chlorine, iron, color, ammonia, and certain total phenols.¹⁰⁷ Therefore, applicants must now demonstrate that a nonconventional pollutant is adequately treated by BPT and water quality-based effluent limits, and will not interfere with the attainment or maintenance of the uses of the waterbody.¹⁰⁸

101. The “conventional pollutant” category now includes: (1) biochemical oxygen demand (BOD, or the amount of oxygen removed from the water by decaying organic material); (2) fecal coliform bacteria concentration (which serves as an indicator species for other more powerful human pathogens); (3) pH (the measure of the acidic or basic qualities of the water); (4) oil and grease; and (5) suspended solids (those pollutants that impact the ability of light to pass into the water column and which thereby affect photosynthesis). See 33 U.S.C. § 1314(a)(4).

102. *Id.* § 1314(b)(4)(B).

103. *Id.* § 1362(13).

104. *Id.* § 1311(b)(2)(F).

105. Federal Water Quality Act of 1987, Pub. L. No. 100-4, 101 Stat. 7 (1989).

106. See 33 U.S.C. § 1311(b)(2)(C).

107. *Id.* § 1311(g)(1).

108. *Id.* § 1311(g)(2).

The 1987 amendments also included increased restrictions on the discharge of toxic substances. Guidelines for modification of BAT deadlines resulting from the incorporation of “innovative technologies” were tightened to require such technologies to have the potential for industry-wide application.¹⁰⁹ Further, the use of “fundamentally different factors” as modifiers of BAT was clarified in the statutory language, prohibiting the use of cost as one of the factors.¹¹⁰

Section 304 of the CWA was amended to require states to identify toxic hotspots, which are waterbody segments where technology-based controls and water quality-based controls are insufficient to achieve WQS. In these waters states must identify the source of the responsible pollutant(s), the amounts of the pollutant(s) discharged, and develop individual control strategies that will lead to achievement of the WQS.¹¹¹ Pursuant to the amendments, states are also required to adopt the EPA’s published water quality criteria for toxic substances upon revising their WQS chapters if they have not adopted criteria for those pollutants.¹¹²

Another significant revision in the 1987 amendments was a statutory clarification of the EPA’s regulatory policy regarding “antibacksliding,” which generally prohibits the EPA from reissuing a NPDES permit that contains effluent limitations less stringent than those contained in the previous permit.¹¹³ Additional adjustments were made in other portions of the CWA with respect to nonpoint source pollution control, penalties, partial NPDES delegation, and storm-water control.¹¹⁴

The employment of assimilative capacity has been at the core of pollution control practices for literally thousands of years.¹¹⁵ More than a century ago, regulators in England were calculating assimilation and dilution potentials to establish in-stream standards for biochemical oxygen demand and ambient oxygen concentration.¹¹⁶ Not surprisingly, pollution levels increased dramatically in magnitude and severity alongside the industrial development of the nation

109. *See id.* § 1311(k).

110. *See id.* § 1311(n)(1).

111. *Id.* § 1314(l).

112. *Id.* § 1314(a)(8).

113. *See id.* § 1342(o).

114. *See* Lawrence R. Liebesman & Elliot P. Laws, *The Water Quality Act of 1987: A Major Step in Assuring the Quality of the Nation’s Waters*, in CLEAN WATER DESKBOOK 21 (ENVIRONMENTAL LAW REPORTER ed., 1988).

115. *See* PERRY & VANDERKLEIN, *supra* note 3, at 51.

116. *See id.* at 33.

throughout the first half of the twentieth century. The passage of the FWPCA in 1948 broadened the definition of pollution to include liquid and particulate wastes.¹¹⁷ The WQS program adopted under the 1965 FWPCA amendments further strengthened administrative controls over polluted discharges. But the fundamental paradigm of pollution control continued to be assimilative capacity; polluted discharges were only considered problematic when the receiving water could no longer absorb or transport pollutants at a rate that would maintain other uses.¹¹⁸

By the late 1960s and early 1970s it was apparent that ambient water protection rules alone were insufficient to control water pollution. With that recognition came a major shift in water pollution law; public waters were no longer to be used as waste treatment systems. The balance of power for management and enforcement shifted back from the states to the federal government and with it a new emphasis was placed on the reduction and elimination of polluted wastestreams. This new philosophy on water pollution control was codified in the 1972 Clean Water Act, which called for the elimination of all polluted discharges “of pollutants into the navigable waters . . . by 1985.”¹¹⁹ More recent amendments to the CWA in 1977 and 1987 further strengthened the statutory prohibitions and protections against the discharge of toxic materials into public waters.¹²⁰ Nonetheless, the simple fact that the NPDES program still authorizes approximately 125,000 municipal and private facilities to release polluted wastestreams into waters of the United States demonstrates that the requisite combination of technological expertise and political will necessary to eliminate the discharge of pollutants into public waters has not been achieved.¹²¹ Despite nearly thirty years of progress since the passage of the CWA, the CWA’s most fundamental goal, zero discharge, remains a distant challenge.

III. MIXING ZONES

A. *Mixing Zones Defined*

Congress declared in 1972 that the assimilation of pollution would no longer be considered a legitimate use of the nation’s waters.

117. See Water Pollution Control Act, Pub. L. No. 80-845, 62 Stat. 1155 (1948).

118. See PERRY & VANDERKLEIN, *supra* note 3, at 38.

119. Clean Water Act, 33 U.S.C. § 1251(a)(1) (1994).

120. See *id.* § 1319(c).

121. See Telephone Conversation with David Hair, Environmental Engineer, EPA, Office of Wastewater Management (Oct. 20, 1999) (on file with author).

The legislative record from the adoption of the 1972 CWA states that “[t]he use of any river, lake, stream or ocean as a waste treatment system is unacceptable.”¹²² Although classifying waste treatment as a use was forbidden, the CWA did not contain specific language categorically supporting or prohibiting any use of dilution for the management of wastewater.¹²³

In 1976, the EPA Office of General Counsel drafted a memo addressing the question of employing dilution as a waste treatment mechanism, in which it stated:

While EPA policy does not categorically forbid the use of flow augmentation or dilution to meet water quality standards, EPA policy discourages the use of flow augmentation as an alternative to treatment for meeting water quality standards. . . . The Act itself is silent on the question of whether this alternative is proper and legal as a method of meeting water quality standards based on concentrations.¹²⁴

Despite the EPA’s discouragement, every state and federal administration since the passage of the CWA has permitted wastes to be diluted within portions of public waters.¹²⁵ The agency’s acquiescence has been based on the assumption that the CWA’s goal to “restore and maintain . . . the integrity of the Nation’s waters” does not forbid portions of waters near outfalls from receiving pollutants at concentrations that exceed ambient water quality criteria.¹²⁶

Regions of waters adjacent to outfalls where wastes are diluted are known as “allocated impact zones,” or mixing zones. Mixing zones are defined in the 1994 EPA Water Quality Standards Handbook as follows: “‘mixing zone’ is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient water body. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented.”¹²⁷

The following excerpt from a state-adopted WQS regulation helps clarify what a mixing zone is, the purposes it serves, and the risks it presents:

A limited mixing zone, contiguous to a point source wastewater discharge, may be allowed in any stream receiving such a discharge. Mixing zones

122. S. REP. NO. 92-414 at 3 (1971), *reprinted in* 1972 U.S.C.C.A.N. 3668, 3674.

123. *See* Memorandum from EPA Office of General Counsel, to the Regional Administrators and State NPDES Directors 1 (Nov. 8, 1976).

124. *Id.* at 1-2.

125. *See* Fogarty, *supra* note 12, at 16-17.

126. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-1.

127. *Id.* at GLOSS-4.

serve as regions of initial dilution which allow the application of a dilution factor in calculations of effluent limitations.¹²⁸

Thus, by definition, mixing zones are areas where water quality standards for individual pollutants are expected to be exceeded, potentially impairing habitat usability for fish and benthic communities.¹²⁹

While the practical result of mixing zone policies is simple enough to grasp, the precise legal foundation for the existence of mixing zone policies is far more challenging to delineate. Therefore, the legal identity of mixing zones under the CWA will be considered before proceeding to the examination of federal and state mixing zone regulations and federal criteria and guidance.

The question of whether mixing zones are legal under the CWA has never been directly put before the federal bench. An examination of the relationship between mixing zones and the permitting mechanisms enacted for pollution control under the CWA is usefully preceded by a review of a Wisconsin Supreme Court decision in 1979 which examined the nature of mixing zone policies in some detail.¹³⁰

The cases that led to the Wisconsin Supreme Court's deliberations were brought in the 1970s when several electric power companies sued the Wisconsin Department of Natural Resources and Wisconsin Natural Resources Board for applying limitations in discharge permits more strictly than the federal permit limitations of the time.¹³¹ The issue centered on the permitting of thermal mixing zones for several electricity-generating facilities. The federal effluent limitations for thermal discharges from electricity-generating facilities on line before 1970 were less restrictive than the limitations placed on newer facilities.¹³² According to the state, the Wisconsin WQS could nonetheless prohibit the temperature of the receiving water at the older facilities from being raised more than three degrees above the existing natural temperature.¹³³ The state agency believed that the federal rule allowing higher discharges should not apply because the permit restrictions were being imposed under the state's mixing zone

128. STATE OF N.M., WATER QUALITY STANDARDS SECTION 1105, APPLICABILITY OF WATER QUALITY STANDARDS 20.6.4.10(D) (1998).

129. See State of N.Y., *Guidance for Toxic Substances Part (s) Chronic and Acute Mixing Zones*, Division of Water Technical and Operational Guidance Series (1.3.1) (on file with author).

130. See *Wis. Elec. Power Co. v. Wis. Natural Res. Bd.*, 280 N.W.2d 218 (1979).

131. *Id.* at 219-20.

132. *Id.*

133. *Id.* at 220.

rule, which it believed to be a state-adopted and state-controlled water quality standard regulation.¹³⁴

The utilities argued that the state's mixing zone rule was an effluent guideline and not a water quality standard, and since Wisconsin had a law that prohibited the state from incorporating any effluent limitation into a permit more stringent than the corresponding federal limitation, the permit restrictions were invalid.¹³⁵ The decision hinged on whether the state's mixing zone rule was a water quality standard or an effluent limitation.

The state circuit court found in favor of the utilities. The Wisconsin Department of Natural Resources filed an appeal with the Wisconsin Supreme Court, and several cases were consolidated as *Wisconsin Electric Power v. Wisconsin Natural Resources Board*.¹³⁶ The Wisconsin Supreme Court began its deliberations by recapping the principles and driving forces behind the passage of the CWA. The court specifically noted the change in goals between the pre-1972 Act and the 1972 Amendments stating that "[w]hereas the goal of the Act had previously been . . . 'to enhance the quality and value of our water resources,' the national goal under FWPCA became the total 'elimination' of discharge of pollutants by point sources into navigable waters by 1985."¹³⁷

Although the CWA does not prohibit states from establishing more restrictive limitations than required by the federal government, the Wisconsin legislature had explicitly limited the authority of the Department of Natural Resources in this regard.¹³⁸ Therefore, the court needed to determine if the mixing zone rule in question was an effluent limitation subject to the sideboards of the Wisconsin statutory provision, or a water quality standard under separate state control.

In forming its decision, the court first noted that water quality standards and effluent limitations were unique constructions, and although not unrelated, the difference between the two was significant in terms of legal result.¹³⁹ The court supported this position by reference to opinions from *Montgomery Environmental Coalition v. Fri*¹⁴⁰ and *Bethlehem Steel v. EPA*.¹⁴¹

134. *Id.* at 224.

135. *Id.* at 233.

136. *Id.* at 219.

137. *Id.* at 222.

138. *Id.* at 223.

139. *Id.* at 224.

140. 366 F. Supp. 261 (D.D.C. 1973).

141. 538 F.2d 513, 516 (2d Cir. 1976).

Having established that the two types of controls were unique, the court then proceeded to characterize each individually. The court cited its previous decision in *Niagara of Wisconsin Paper Corp. v. Wisconsin Department of Natural Resources* and stated that “[a] water quality standard is a measurement of the water itself and *it does not focus on any single pollutor* (sic) but necessarily comprehends all discharges, into a given body of water.”¹⁴² Having established that effluent limits applied to discharges and water quality standards applied to measurements taken in the receiving water, all that remained for the court to determine was the category of restrictions to which mixing zone regulations belonged.¹⁴³

The court found that mixing zones were limitations established for application to point sources, citing the Wisconsin rule regarding thermal discharges that permitted the department to “adjust the boundaries of the mixing zone for that source.”¹⁴⁴ Furthermore, the court found that “the language of the rule explicitly referred to discharges, and thus the effluent limitation character of the section was apparent”¹⁴⁵ In conclusion the court stated:

The effect of the mixing zone concept is that discharges from particular point sources will be identifiable The DNR argues that the mixing zone concept is often used in water quality standards. This may be so; but when the effect is so clearly to allow the DNR to limit the amount of heat a given source can discharge, the conclusion must be that it is an effluent limitation¹⁴⁶

The Wisconsin Supreme Court therefore determined that while mixing zones may be considered implementation policies for WQS, they are in fact effluent limitations and not water quality standards.¹⁴⁷ But simply accepting that mixing zones are effluent limitations does not fully answer the question of where mixing zones reside under the CWA. The controls and guidelines adopted by Congress for the application of effluent limitations must be examined.

The term “effluent limitation” is defined in section 502 of the CWA.¹⁴⁸ Several basic categories of effluent limitations were created

142. *Wis. Elec.*, 280 N.W.2d at 225 (quoting *Niagara of Wis. v. Wis. Dep’t of Natural Res.*, 268 N.W.2d 153, 163 (1978)) (emphasis added).

143. *See id.*

144. *Id.* (citing Wis. Stat. § 147.021, NR 102.05(1)(c) (1975)).

145. *Id.*

146. *Id.* at 226.

147. *Id.*

148. “The term ‘effluent limitation’ means any restriction established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the

under section 301 of the CWA. The first category required the Administrator to adopt effluent limitations for point sources by certain dates that met the test of Best Practicable Control Technology Currently Available (BPT).¹⁴⁹ These were to be applied to existing point sources at the time of the adoption of the CWA.¹⁵⁰ A second category of effluent limits was adopted to address secondary treatment of wastewater in publicly owned treatment works either constructed before 1977 or approved before 1974.¹⁵¹ A third type of effluent limit, the Water Quality-Based Effluent Limits (WQBEL), were specifically required to lead to the attainment of WQS.¹⁵²

Section 301 of the CWA also established the EPA's responsibility to develop effluent limits on the basis of the Best Available Technology (BAT).¹⁵³ As stated in the CWA, BAT effluent limits developed for toxic pollutants and nonconventional pollutants "shall require the application of the best available technology economically achievable for such category or class, which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants."¹⁵⁴ Section 301 further addresses the development of Best Conventional Pollutant Control Technology (BCT) effluent limits for the conventional pollutants listed under section 304.¹⁵⁵ Finally, a category of effluent limits was created to address specific point sources that would not meet WQS even after the application of the BAT limits. Under section 302 of the CWA *Water quality related effluent limitations*, the law states:

Whenever . . . discharges of pollutants from a point source or group of point sources, with the application of effluent limitations required under section 1311(b)(2) of this title, would interfere with the attainment or maintenance of that water quality in a specific portion of the navigable waters which shall assure protection of public water supplies, . . . protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water, effluent limitations (including alternative effluent control strategies) for such point

contiguous zone, or the ocean, including schedules of compliance." Clean Water Act, 33 U.S.C. § 1362(11) (1994).

149. *Id.* § 1311(b)(1)(A).

150. *Id.*

151. *Id.* § 1311(b)(1)(B).

152. *Id.* § 1311(b)(1)(C). WQBEL are defined as "any more stringent limitation, necessary to meet water quality standards, treatment standards, or schedules of compliance, established pursuant to any State law or regulation." *Id.*

153. *See id.* § 1311(b)(2)(A).

154. *Id.*

155. *Id.* § 1311(b)(2)(E).

source or sources shall be established which can reasonably be expected to contribute to the attainment or maintenance of such water quality.¹⁵⁶

So, what manner of effluent limitation is a mixing zone policy?

Although individual aspects of mixing zones can be identified in the various effluent limitation mechanisms provided by the CWA, each of those sections also contains language inconsistent with current mixing zone application.¹⁵⁷ For example, mixing zones are routinely provided for new sources regulated under BAT; therefore, section 301 guidelines for facilities existing at the time of adoption of the CWA or shortly thereafter cannot be taken as the generic justification for mixing zone authorization.¹⁵⁸ Water quality-based effluent guidelines do not fit the bill, since they are intended to assure the meeting of WQS by the application of “any more stringent limitation.”¹⁵⁹ Mixing zones are not more stringent effluent limitations. To the contrary, they result in the application of less stringent WQS-based effluent limits. BAT limits do not support the application of mixing zones because they are specifically directed to apply to categories and classes of dischargers and not specific permit limits.¹⁶⁰ Furthermore, section 302 effluent limits do demonstrate the site-specificity seen in mixing zone applications.¹⁶¹ But they do not appear to encompass the broader notion of mixing zones, since the goal of the section is to provide for the adoption of effluent limits that will ensure the achievement of WQS in “a specific portion of the navigable waters.”¹⁶²

Therefore, by virtue of their permit-specific application and their direct impact on permit limits, mixing zones appear to be most closely aligned with effluent limitation mechanisms, which are intended to lead to the attainment of state WQS and federal criteria as well as the protection of uses in public waters. Yet the *raison d'être* of mixing zones is not to ensure the achievement of state water quality standards and federal criteria, but to weaken otherwise applicable WQS and federal criteria. In essence, the purpose of assigning a mixing zone is to legalize a discharger’s noncompliance by incorporating a dilution factor calculated on the basis of an assumed reservoir of assimilative capacity. Therefore, rather than resolving the question of a home for mixing zones under the CWA, we are left with a more troubling

156. *Id.* § 1312(a).

157. *See id.* § 1311(b).

158. *See id.* § 1311(b)(2)(A).

159. *Id.* § 1311(b)(2)(C).

160. *See id.* § 1311(b)(2)(A).

161. *See id.* § 1312(a).

162. *Id.*

question. Are mixing zones legitimate effluent limitation mechanisms under the CWA, since they do not lead to the achievement of WQS and federal criteria, but simply provide a mechanism by which these standards are relaxed?

B. Mixing Zones and Federal Regulation

Federal water quality regulations serve two general purposes regarding the adoption of state and tribal water quality regulations. One is to address the review of standards and regulations adopted by states and tribes;¹⁶³ the other is to set standards and regulations for states and tribes that have either not adopted policies or adopted policies inconsistent with the goals and purposes of the CWA.¹⁶⁴ Mixing zones have been addressed, albeit briefly, under both categories.

Direct federal support for state and tribal adoption of mixing zone policies is found in federal regulation under the heading *General Provisions* and states that “[s]tates may, at their discretion, include in their State standards, policies generally affecting their application and implementation, such as mixing zones, low flows, and variances. Such policies are subject to EPA review and approval.”¹⁶⁵ Aside from these *General Provisions*, state and tribal regulatory policies for mixing zones are only specifically referenced in EPA-promulgated water quality standards for the Colville Confederated Tribes Indian Reservation in the State of Washington.¹⁶⁶ While this agency-promulgated regulation does not have national legal application, it does present a certain measure of perspective on the EPA’s attitude toward the use of mixing zones. However, as described below, this EPA-promulgated rule does not demonstrate a consistent agency position on mixing zone authorization.

163. See Water Quality Standards, 40 C.F.R. § 131.1 (2000).

164. See 33 U.S.C. § 1313(a).

165. 40 C.F.R. § 131.13. The EPA noted in the preamble to the 1983 Federal Register publication of this regulation that detailed statements were deleted from the regulation after comments from the public convinced the agency that the statements were not regulatory in nature and would be more appropriately presented in guidance. Water Quality Standards Regulation, 48 Fed. Reg. 51,400, 51,401-02 (Nov. 8, 1983). Inquiries were made to the EPA during this investigation for any legal analysis that might have preceded the adoption of the regulation, since no justification was provided in the federal register notice or preamble regarding the presumption of legality for the issuance of mixing zones under the Act. EPA staff reported that no such analysis either by the EPA or the Department of Justice was believed to exist. See Telephone Conversation with Susan Gilbertson, Staff Assistant, EPA, Office of Water (June 1999) (on file with author).

166. See 40 C.F.R. § 131.35.

In the subsection entitled *Aesthetic Qualities* of the Colville Reservation water quality standards, the federally promulgated regulation states in relevant part that “[a]ll waters within the Reservation, including those within mixing zones, shall be free from substances, attributable to wastewater discharges or other pollutant sources that . . . [c]ause injury to, are toxic to, or produce adverse physiological responses in humans, animals, or plants.”¹⁶⁷ This language could be interpreted to preclude the discharge of a substance at any concentration if the substance has demonstrated the ability to produce toxic effects. Since numerous other EPA guidance documents do not corroborate that interpretation, it must be assumed that the agency’s intent was less restrictive.¹⁶⁸ It is more likely that the language was intended to prohibit the discharge of a substance into waters within or outside of mixing zones at concentrations that would adversely affect human health or aquatic life.¹⁶⁹

The *Definitions* section of the Colville regulation defines a mixing zone as an area or volume of water where “acutely toxic conditions” are prevented from occurring.¹⁷⁰ This statement clarifies three critical doctrines of EPA policy. First, toxic substances may be discharged in potentially toxic amounts. Second, since only acutely toxic conditions are being prohibited, creating chronically toxic conditions may be assumed to be legitimate. Third, the EPA is assuming that regulators are capable of determining time-exposures in waters that exceed acute or chronic criteria and result in acute or chronically toxic effects to various forms of aquatic life.¹⁷¹ All three of these positions conflict with the provision cited above requiring discharges to “be free from substances” at concentrations that cause toxic effects.

Two other references in the federally promulgated Colville Reservation WQS regulation can be construed to address mixing zones. The first reference appears in the restrictions on temperature variation from thermal discharges.¹⁷² In this instance, calculations for permissive temperature changes are described across “dilution zones,” which are otherwise not defined.¹⁷³ The second reference arises in a subsection on toxic discharges that states “[t]oxic, radioactive, non-

167. *Id.* § 131.35(e)(3).

168. *Compare id.*, with *id.* § 131.12(2).

169. *See id.* § 131.2.

170. *Id.* § 131.35(d)(8).

171. *See id.*

172. *See id.* § 131.35(f)(1)(G)(ii)(D)(2).

173. *Id.*

conventional, or deleterious material concentrations shall be less than those of public health significance, or which may cause acute or chronic conditions to the aquatic biota, or which may adversely affect designated water uses.”¹⁷⁴ This statement again conflicts with the requirement that discharges be free from potentially toxic substances discharged in toxic amounts, a result routinely accepted in the practice of mixing zone authorization.

It is worth noting that the Confederated Tribes of the Chehalis Reservation, also located in Washington State, have promulgated WQS provisions for mixing zones that explicitly allow chronic and acute criteria to be exceeded.¹⁷⁵ Similarly, WQS adopted by the Puyallup Tribe of Indians in Washington State clearly authorize the potential for dischargers to exceed pollutant criteria within mixing zones.¹⁷⁶ The EPA is not bound when promulgating regulations to adopt the same standards by which they review regulations proposed by states or tribes.¹⁷⁷ However, inconsistent policies in otherwise similar portions of public waters challenge a basic notion of fairness. Congress specifically sought to prevent dischargers from pollution shopping for weaker regulations in order to reduce waste treatment costs when it reestablished federal control over water pollution management in 1972.¹⁷⁸

Where discharge zones overlap with state territorial waters, state WQS are applied to determine effluent limits. As a discharge point moves further out to sea from the coastline, state WQS play a progressively smaller role.¹⁷⁹ Because the federal government has promulgated very few marine criteria, mixing zones for facilities located more than three miles offshore are based on a limited number of biological measures such as acute or chronic aquatic life criteria.¹⁸⁰

174. *Id.* § 131.35 (f)(2)(ii)(G).

175. Confederated Tribes of the Chehalis Res. Res. 96-2, Sec. 9 (1996).

176. *See* Puyallup Tribe of Indians Res. 010894-E, Sec. 9 (1994). “Water quality criteria shall not be violated outside of the boundary of the mixing zone as a result of the discharge for which the mixing was authorized.”

177. *Compare* 40 C.F.R. § 131.22, with 40 C.F.R. § 131.21.

178. *See* Van Putten & Jackson, *supra* note 80, at 871. The EPA has promulgated mixing zone regulations apart from the policies described above. Under *Subpart M—Ocean Discharge Criteria*, federal regulations define the term “mixing zone,” and briefly describe how mixing zones will be applied in NPDES permits. *See* 40 C.F.R. §§ 125.123(d)(1)(i), 125.121(c). The ocean discharge criteria are applied to NPDES permits that address the release of pollutants into the territorial seas, the contiguous zone, and the oceans by offshore facilities such as seafood processing plants and oil drilling platforms. *See id.* § 125.120.

179. *See* Telephone Conversation with Bernie Hill, EPA, Region X, Office of Water (Aug. 2000) (on file with author).

180. *See id.*

Mixing zone size is authorized under the ocean discharge criteria in one of two ways. The mixing zone may be designated as the volume of water from seabed to surface extending laterally from the discharge point to a distance of 100 meters in all directions from the discharge point.¹⁸¹ Alternatively, it may be determined by the boundary of the zone of initial dilution, if that provides for a larger mixing zone.¹⁸² The regulatory definition provides the director with the power to use some other method of determining the mixing zone size where appropriate.¹⁸³

Nonetheless, these two methods raise further questions regarding the consistency of EPA mixing zone policy. The EPA may define offshore mixing zones as regions 100 meters or greater from a discharge point with relatively little analysis. Yet the agency advises states to base their determinations on site specific information and to authorize mixing zones that are as small as practicable.¹⁸⁴ More confusing however, is ocean discharge criteria's equating of the terms mixing zone and "zone of initial dilution" (ZID). As described below, a ZID is a region immediately adjacent to an outfall where acute and chronic criteria are not met. The outer boundary of a ZID is not normally considered the outer edge of the entire mixing zone, since beyond a ZID lies the secondary, or ambient, mixing region where chronic criteria are still not met.¹⁸⁵

One other federal water quality regulation weighs heavily on any legal presumption for mixing zones. Federal regulation requires states to include an "antidegradation policy" (ADP) that meets or exceeds the federal ADP protections in every water quality standards package submitted to the EPA for review.¹⁸⁶ The federal ADP provides that when lowering water quality is permitted, "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected."¹⁸⁷ The EPA maintains that the authorization of mixing zones is consistent with the federal ADP, despite the fact that water quality in mixing zones is routinely lowered to the point of eliminating uses in portions of waters.¹⁸⁸ Presumably, the agency's position is again based on the

181. Criteria and Standards for the National Pollutant Discharge Elimination System, 40 C.F.R. § 125.121(c) (2000).

182. *See id.*

183. *See id.*

184. *See* EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-1.

185. *See* EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

186. *See* 40 C.F.R. § 131.6(d).

187. *Id.* § 131.12(a)(1).

188. *See* EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, app. G-5.

principle that use removal is permitted in mixing zones if the enjoyment of the use is not restricted in the waterbody as a whole.

Most states have either adopted the federal ADP by reference or adopted its equivalent into their regulatory packages.¹⁸⁹ In at least one instance a state has not felt confident that the federal ADP adequately supported its ability to exceed criteria or remove uses within the boundaries of mixing zones.¹⁹⁰ The Alaska ADP was specifically amended in 1987 to exempt waters within mixing zones and waters above zones of deposit from receiving ADP protection.¹⁹¹ Most states have assumed the right to limit the application of the ADP to public waters outside mixing zones without referencing the fact in their regulations. However, there is no indication that this presumption is supportable by federal regulation or the CWA. The issue has not been challenged in federal court.

In contrast to the advice provided in the *Water Quality Standards Handbook*, the federal ADP further states that existing water quality must be maintained even when it exceeds levels necessary to protect a given use, unless “lower[ing] water quality is necessary to accommodate important economic or social development.”¹⁹² In practice, the requirement of linking the need for a mixing zone to important economic or social development is routinely ignored in state regulations, which suggest the existence of a *pro forma* right to receive a mixing zone.¹⁹³

The EPA published an “advanced notice of proposed rule making” (ANPRM) in July of 1998, stimulating a national debate on potential changes to the federal water quality regulations.¹⁹⁴ The EPA included the federal mixing zone regulation on the ANPRM list of regulations for which comments were requested.¹⁹⁵ The ANPRM

189. See EPA, INTRODUCTION TO WATER QUALITY STANDARDS, *supra* note 27, at 15-16.

190. See ALASKA ADMIN. CODE tit. 18, § 70 (Aug. 1987).

191. See *id.* § 70.010(c)(2).

192. 40 C.F.R. § 131.12(a)(2).

193. “All surface water quality standards in this rule . . . are to be applied at a point outside of the mixing zone to allow for a reasonable admixture of waste effluents with the receiving waters.” IND. ADMIN. CODE tit. 327 r. 2-1-4 (1998). “Mixing zones are recognized as being necessary for the initial assimilation of point source discharges which have received the required degree of treatment or control.” IOWA ADMIN. CODE r. 567-61.2(4) (1990). “The presence of a mixing zone in a receiving water is accepted as a normal and expected consequence of a wastewater discharge. A mixing zone is that portion of the receiving waterbody which either surrounds or is immediately downstream of a point source discharge and where the concentration of the discharged material is progressively diluted by the receiving water until, at some distance from the discharge point, the applicable water quality criteria are satisfied.” STATE OF N.Y., *supra* note 129, at 1.3.1.

194. See Water Quality Standards Regulation, 63 Fed. Reg. 36,742 (July 7, 1998).

195. See *id.* at 36,787.

discusses the relationship between narrative criteria and mixing zone regulations, conspicuously displaying the contradiction described earlier between federally promulgated standards and federally approved standards.¹⁹⁶ “EPA has consistently maintained that prevention of nuisance conditions (e.g., materials that will settle to form objectionable deposits, floating debris, oil, scum, foam and other matter, toxic conditions, etc.) through the application of narrative criteria, apply to all waters, at all times, including mixing zones.”¹⁹⁷ The EPA claims in the ANPRM to have consistently maintained a position against creating toxic conditions in all waters at all times, including in mixing zones.¹⁹⁸ Yet the EPA has allowed virtually every state, tribe, and territory to authorize mixing zones where acute and chronic criteria are exceeded and where chronic conditions are explicitly permitted.¹⁹⁹ The EPA also acknowledged in the ANPRM that federal regulation regarding the development and implementation of mixing zones has lacked sufficient regulatory specificity, and that states have been arbitrarily interpreting the federal mixing zone rule with an overly broad range of procedures.²⁰⁰

In fact, the EPA’s assertion of a high degree of variability between state mixing zone regulations is well founded. For example, with respect to the application of size restrictions on mixing zones, Alaska maintains the discretion to disregard its recommended size restrictions based on the ratio of the mixing zone’s surface area to the surface area of the receiving water.²⁰¹ A similar provision for waiving size restrictions is provided in the Virginia WQS.²⁰² Yet in Washington, mixing zones are forbidden from extending beyond the more stringent choice between precise ratios of mixing zone flow and surface area to receiving water flow and surface area.²⁰³

A similar situation exists with respect to the types of waters in which mixing zones are permitted. Idaho does not restrict the application of mixing zones in any class of waterbody, including waters listed as “Outstanding Resource Waters”;²⁰⁴ whereas South

196. *See id.* at 36,791.

197. *Id.*

198. *See id.*

199. *See id.* at 36,788.

200. *See id.* at 36,787.

201. ALASKA ADMIN. CODE tit. 18, § 70.255(e) (Apr. 1998).

202. COMMONWEALTH OF VIRGINIA, DEP’T OF ENVTL. QUALITY, WATER DIVISION, RECOMMENDATIONS FOR IMPLEMENTATION OF THE MIXING ZONE STANDARD 6 (Feb. 14, 1995) (on file with author).

203. *See* WASH. ADMIN. CODE § 173-201A(7)(a) (Nov. 1997).

204. IDAHO ADMIN. CODE § 58.01.02.060.02 (1998).

Dakota permits mixing zones in any flowing waters but prohibits mixing zones in lakes.²⁰⁵ Meanwhile in the State of Vermont, mixing zones are prohibited in all Class A waters,²⁰⁶ defined as waters used solely as drinking water supplies or other high quality waters,²⁰⁷ yet mixing zones are allowed in drinking water supply waters that serve multiple uses known as Class B waters.²⁰⁸ The EPA intended to publish draft revisions to the federal water quality mixing zone regulation in order to address these regulatory irregularities in the year 2000.²⁰⁹ However, the EPA's effort to do so was not completed before the close of the Clinton Administration.²¹⁰

C. *Mixing Zones and Federal Criteria*

Mixing zones were first explicitly established in federal guidance in the 1968 support document *Water Quality Criteria* ("Green Book") in a chapter entitled *Zones of Passage*, which described the importance of providing fish with unpolluted corridors for migration.²¹¹ The authors of the Green Book established two important principles for the application of mixing zones. First, regions of mixing are effectively distinguishable from adjacent areas within the receiving water, and water quality controls should be focused on protecting uses in the waterbody-as-a-whole rather than throughout the entire waterbody.²¹² Second, the focal point for federal protection should be to maintain fish populations and not necessarily to be concerned with other aquatic organisms, consumers of fish, or other indirect users of the waterbody.²¹³

The Green Book clearly supported the application of mixing zones; however, it also recommended that prior to their authorization potentially toxic discharges be determined "harmless in the

205. S.D. ADMIN. R. 74:51:01:26, 74:51:01:27 (1997).

206. VT. ENVTL., HEALTH AND SAFETY REGULATIONS § 2-04(A)(1) (1994).

207. See Telephone Conversation with Jerome McArdle, Water Resources Planner, State of Vermont, Department of Environmental Conservation (Aug. 1999) (on file with author).

208. VT. ENVTL., HEALTH AND SAFETY REGULATIONS § 204(A)(1).

209. See Telephone Conversation with Charles Fox, Assistant Administrator, EPA, Office of Water (July 2000) (on file with author).

210. See Telephone Conversation with Charles Fox, Assistant Administrator, EPA, Office of Water (Dec. 2000) (on file with author).

211. See NAT'L TECH. ADVISORY COMM., *supra* note 53, at 31. The Federal Water Pollution Control Administration's acceptance of mixing zones as a regulatory mechanism was clearly demonstrated in the letter of transmittal from Commissioner Moore of the Federal Water Pollution Control Administration to the United States Department of Interior outlining "[a] recommendation that all waters, except those adjacent to outfalls, provide for the maintenance and production of fish." *Id.* at i.

212. See *id.* at 31.

213. See *id.*

concentrations to be found in the receiving waters.”²¹⁴ According to the Green Book, the burden of proof regarding toxicity should reside with the parties responsible for the discharge.²¹⁵ The EPA’s *Water Quality Criteria* (“Blue Book”), drafted by the National Academy of Sciences and the National Academy of Engineering, was published five months after the CWA was adopted.²¹⁶ The Blue Book articulated the EPA’s acceptance of the importance of mixing zones, placing the discussion of zones of passage into a chapter on *Mixing Zones* in contrast to the Green Book’s placement of mixing zones within the chapter *Zones of Passage*.²¹⁷ The Blue Book reinforced the agency’s policy that beneficial uses in all portions of all waters, i.e., within mixing zones, need not be protected.²¹⁸ The issue of protecting beneficial uses did not, however, seem completely settled in the Blue Book. Recommendations provided under *Definition of a Mixing Zone* called for the protection of uses within mixing zones:

Although water quality characteristics in mixing zones may differ from those in receiving systems, to *protect uses in both regions* it is recommended that mixing zones be free of substances attributable to discharges or wastes as follows: materials which form objectionable deposits; scum, oil, and floating debris; substances producing objectionable color, odor, taste, or turbidity; conditions which produce objectionable growth of nuisance plants and animals.²¹⁹

The Blue Book suggested that aquatic ecosystems might be protected despite significant pollution impacts on some portion of the biota.²²⁰ This is evidenced by their comment that species in an ecosystem could be defined as “important.”²²¹ Presumably other species must therefore be unimportant and can be eliminated without damaging the ecosystem.²²²

214. *Id.* at 34.

215. *See id.* The report of the National Technical Advisory Committee stated that “[a]ll effluents containing foreign materials should be considered harmful and not permissible until bioassay tests have shown otherwise. It should be the obligation of the agency producing the effluent to demonstrate that it is harmless in the concentrations to be found in the receiving waters.”

216. *See* NAT’L ACAD. OF SCI. & NAT’L ACAD. OF ENG’G, WATER QUALITY CRITERIA (1972); Telephone Conversation with Ann Winther, Staff Assistant, EPA, Region X, Office of Water (Dec. 1998) (on file with author).

217. *See* NAT’L ACAD. OF SCI., *supra* note 216, at 112-15.

218. *See id.* at 112. “At that boundary, receiving system water quality characteristics based on long term exposure will protect aquatic life.” *Id.*

219. *Id.* (emphasis added).

220. *Id.* at 113.

221. *Id.*

222. *See id.* “The mixing zone may represent a living space denied the subject organisms . . . a decision should be made in each case whether the nonmobile benthic and sessile organisms

Finally, the Blue Book fully accepted the role of politics in mixing zone decisions. As stated in the Blue Book section entitled *Proportional Relationships of Mixing Zones to Receiving Systems*, “[r]ecommendations for mixing zones do not protect against long-term biological effects of sublethal conditions The decision as to what portion and areas must be retained at receiving water quality is both a social and scientific decision.”²²³ The *Quality Criteria for Water* (“Red Book”) was published in 1976. The Red Book stayed the federal government’s course on mixing zones.²²⁴ Interestingly, in the *Introduction* section of the Red Book’s mixing zone chapter the EPA states that “[t]he mixing zone should be considered as a place where wastes and water mix and not as a place where effluents are treated.”²²⁵

Although this statement could be interpreted to show support for Congress’s intent to eliminate the use of public waters as waste treatment mechanisms, in practice, dilution continued to play a significant role in water pollution management.²²⁶ Simply put, the modification of an effluent limit by inclusion of a mixing zone dilution factor increases the allowable concentration of the pollutant in the effluent. The application of a sufficiently large mixing zone can make any discharge appear to achieve applicable water quality standards when, in fact, the water quality standards have merely been adjusted to be less stringent. The dilution factor permits pollutant loading at the end of the pipe to be increased, thereby reducing the dischargers’ responsibility to treat the wastestream prior to its release. Therefore, the dilution of pollutants in mixing zones is for all practical purposes functioning in a manner analogous to a treatment mechanism. The EPA later reversed the Red Book’s rhetoric regarding dilution and treatment by acknowledging that mixing does directly affect treatment requirements.²²⁷ In the 1991 *Technical Support Document for Water Quality-Based Toxics Control* (TSD), the EPA stated that “[m]ixing zone allowances will increase the mass loadings of the pollutant to the waterbody, and decrease treatment requirements.”²²⁸ The Red Book also addressed the resulting harm from mixing zones to aquatic life. The question was not proposed as

are to be protected In populations of important species, effects of total time exposure must not be deleterious either during or after exposure.” *Id.*

223. *Id.* at 114-15.

224. See EPA, QUALITY CRITERIA FOR WATER (July 1976).

225. *Id.* at 103-04.

226. See S. REP. NO. 92-414 at 4 (1971), reprinted in 1972 U.S.C.C.A.N. 3668, 3676.

227. See EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

228. *Id.*

a matter of *if*, but of *how much*. “[T]he permissible size of a mixing zone is dependent upon the acceptable amount of damage [T]he larger the water body, the larger the mixing zone may be without violating water quality standards in more than a given percentage of the total area or volume of the receiving water.”²²⁹

This statement attests to a direct relationship between anticipated ecological impacts and the mixing zone volume/receiving water volume ratio. Despite the significant uncertainties inherent in predicting ecological effects from pollution, the volume ratio concept is routinely used as a guide for the allocation of mixing zones.²³⁰ For example, dischargers into San Francisco Bay in California who demonstrate a ten-fold dilution potential between the receiving water and the effluent volume are granted “deep water” permits, with end-of-pipe effluent limits calculated to reflect the ten-fold dilution.²³¹ In granting these deep water permits with de facto ten-fold mixing zones, no direct determination is regularly made to assess immediate or cumulative impacts on the ecosystem, or to assess whether a ten-fold dilution is even necessary for all components of the discharge to meet WQS.²³²

The Red Book also recommended that to protect aquatic life within a mixing zone, acute toxicity criteria should not be exceeded.²³³ This recommendation has been subtly but significantly modified in the TSD.²³⁴ The EPA now supports exceeding acute criteria as long as acutely toxic *conditions* are not expected to result.²³⁵ The TSD describes in detail the application of mixing zones where acute criteria are exceeded, known as “zones of initial dilution” (ZID).²³⁶ In 1986, the EPA published its current guidance document on water quality criteria, known as the Gold Book.²³⁷ Although the Gold Book contains updated information on the toxic effects of many pollutants, it offers no new guidance regarding mixing zones.

229. EPA, QUALITY CRITERIA, *supra* note 224, at 103.

230. *See id.*

231. *See* STATE OF CAL. REG’L WATER QUAL. BD., WASTE DISCHARGE REQUIREMENTS FOR UNION OIL CO. OF CAL. ORDER NO.94-129 NPDES No.CA0005053, at 10 (Sept. 1994).

232. *See* Telephone Conversation with Susan Stonich, Staff Assistant, Earth Island Institute (October 1999) (on file with author).

233. EPA, QUALITY CRITERIA, *supra* note 224, at 103.

234. *See* EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

235. *Id.*

236. *See id.*

237. EPA, WATER QUALITY CRITERIA (EPA 440/5-86-001, 1986).

D. *Mixing Zones and Federal Guidance/Technical Support*

As previously noted, the EPA published a comprehensive manual for controlling toxic discharges in 1991; the *Technical Support Document for Water Quality Based Toxics Control* (TSD) which included several sections of guidance on the nature and implementation of mixing zones.²³⁸ The TSD describes two stages of mixing within the typical mixing zone. The region of initial dilution is called the primary mixing zone and is dependent upon the momentum and buoyancy of the effluent.²³⁹ Primary mixing is estimated through modeling studies and is influenced by the type of diffuser employed, the number of discharge ports in the diffuser, and the momentum of the effluent.²⁴⁰ Modeling can use simple order-of-magnitude dilution calculations or more sophisticated mathematical constructions based on idealized field conditions.²⁴¹ The models generally require information on the discharge depth, effluent flow rates, effluent density, density gradients in the receiving water, ambient current speed and direction, and physical characteristics of the outfall.²⁴² Secondary mixing is facilitated by ambient turbulence and is dependent upon the physical and chemical characteristics of the receiving water.²⁴³ Ambient mixing models are used to predict the lateral and complete mixing zone boundaries.²⁴⁴

Mixing is considered "complete" at the location where the concentrations of pollutants across any transect of the waterbody differ by less than five percent.²⁴⁵ Determining the point of complete mixing is an important aspect of mixing zone design and is achieved by studies that employ chemical tracers or by modeling.²⁴⁶

Three categories of mixing zones are commonly specified based on the desired level of protection.²⁴⁷ Mixing zones can be designed to reflect acute or chronic aquatic life criteria, or to protect human health from chronic exposure.²⁴⁸ In the innermost zone surrounding the

238. See EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

239. *Id.* at 75.

240. *Id.* at 76.

241. *Id.*

242. *Id.*

243. *Id.* at 77.

244. *Id.*

245. *Id.* at 72.

246. Detailed information on modeling protocols can be found in E.R. HOLLEY & G.H. JIRKA, MIXING IN RIVERS TECHNICAL REPORT E-86-11 (1986) (issued for U.S. Army Engineer Waterways Experiment). See also HUGO B. FISCHER ET AL., MIXING IN INLAND AND COASTAL WATERS (1979).

247. See EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

248. See *id.*

outfall, also known as the ZID, neither acute nor chronic criteria are met.²⁴⁹ According to the EPA, even though acute criteria are exceeded in the ZID, acutely toxic conditions are not necessarily created. To experience acutely toxic conditions organisms must be present in the acute criteria mixing zone for a length of time considered sufficient to cause toxicity.²⁵⁰ The EPA recommends that the momentum of the discharge at the outfall be sufficient to physically force organisms out of the ZID and into waters where the pollutant has been diluted sufficiently to meet the acute criteria.²⁵¹ Calculating the average time exposure of potentially impacted biota is part of the mixing zone design process.

The practice of exceeding acutely toxic criteria in state or tribally authorized mixing zones is acceptable to the EPA unless modeling predicts lethality to aquatic organisms passing through the mixing zone.²⁵² Most, if not all, states permit acute criteria to be exceeded in mixing zones in public waters.²⁵³ The EPA recognizes that some states are following selected portions of federal guidance published in the TSD and are applying acute aquatic life mixing zones that only address lethality to passing organisms.²⁵⁴ In the recently proposed notice of federal rulemaking (“ANPRM”) regarding WQS and mixing zones, the EPA questioned the legitimacy of designing acutely toxic mixing zones to this standard.²⁵⁵ The agency stated that since 1972, it has “consistently emphasized the need to protect both nonmotile benthic and sessile organisms in the mixing zone as well as swimming and drifting organisms.”²⁵⁶ To address this concern, the EPA recommends mixing zones be sited in areas that will minimize the impact to benthic biota.²⁵⁷ It is interesting to contrast this concern for

249. *Id.*

250. *Id.*

251. *Id.*

252. *See id.* at 70.

253. “Acute aquatic life criteria apply at and beyond the boundaries of a smaller initial mixing zone surrounding the outfall.” ALASKA ADMIN. CODE tit. 18, § 70.255(d) (1979). “Acute aquatic life toxicity numerical data shall be applied at the edge of the zone of initial dilution.” STATE OF LA. *MIXING ZONES AND RELATED FLOWS* Cpp. 1994/Oct. 1995 (on file with author). “There may be a zone of initial dilution (ZID) which exceeds the acute toxicity.” STATE OF ARK. APDCE DISCHARGE PERMIT, TOXIC CONTROL IMPLEMENTATION PROCEDURE PART A (1991).

254. *See* Water Quality Standards Regulation, 63 Fed. Reg. 36,742, 36,788 (July 7, 1998).

255. *See id.* at 36,791.

256. *Id.* EPA’s concern for the impacts of mixing zones on nonmotile species is further supported elsewhere in the TSD. “[M]ixing zones . . . adversely impact immobile species, such as benthic communities, in the immediate vicinity of the outfall.” EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

257. *See id.* at 34. Guidance supporting such protection is also found in the 1994 *WQS Handbook*, the section on antidegradation. “Species that are *in* (sic) the waterbody and which are

all biota with the Blue Book recommendations cited earlier regarding the protection of “important” species.

At the edge of the ZID the acute aquatic life criterion is met but the chronic aquatic life criterion is still exceeded. The chronic aquatic life criterion is not met until the boundary of the outer mixing zone is reached.²⁵⁸ A fundamental distinction exists between acute and chronic mixing zones beyond the simple fact that acute mixing zones permit higher concentrations of pollutants. Acute criteria mixing zones are designed to prevent the creation of acutely toxic conditions, while chronic criteria mixing zones encompass a region in which chronically toxic conditions are assumed to continually exist.²⁵⁹

The EPA recommends in the TSD that states clearly and carefully describe the procedures for defining mixing zones, since disproportionately large mixing zones could potentially adversely impact the ecosystem.²⁶⁰ Parameters to be considered when designing mixing zones include location, size, shape, outfall design, in-zone quality, applicable toxicological criteria, topographic and oceanographic data, and potentially impacted uses.²⁶¹ In addition, the EPA recommends that magnitude (concentration of the pollutant), duration (the length of time over which the instream concentration is averaged for comparison to the criterion concentration), and frequency (how often the criteria will be exceeded) parameters be considered as well.²⁶²

Most state WQS include numerical criteria for only a limited number of individually toxic chemicals.²⁶³ Therefore, evaluation and control of toxic pollutants often relies on the application of narrative criteria that prohibit the discharge of toxic materials in toxic amounts.²⁶⁴ To apply these narrative criteria, the EPA recommends that parameters such as bioaccumulation, persistence, additivity, synergism, and antagonism be considered.²⁶⁵ To protect against the

consistent with the designated use (i.e., not aberrational) must be protected, even if not prevalent in number or importance.” EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, app. G-3.

258. See EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-3. The State of Missouri’s WQS regulations clearly illustrate the application of this principle: “Mixing Zone—An area of dilution of effluent in the receiving water beyond which chronic toxicity criteria must be met.” MO. CODE REGS. ANN. tit. 10, § 20-7.031(N) (1996).

259. See EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

260. *Id.*

261. EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-2 to 5-6.

262. EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 32.

263. See *id.* at 34.

264. See *id.*

265. *Id.*

toxicity of chemicals without numeric standards and to assess multiple pollutant toxicity, the EPA recommends that states employ “whole effluent toxicity” (WET) standards to test the impact of an effluent on appropriate test species or indigenous organisms.²⁶⁶ Results of this testing are translated into “toxic units,” which can be related to various levels of acute or chronic toxicity or protection. The acute WET criterion and the chronic WET criterion can be assigned to mixing zones in a manner analogous to other criteria.

The EPA recommends that to protect human health, mixing zones should not present significant human health risks after consideration of all potential exposure pathways.²⁶⁷ Therefore, mixing zones should not encroach on drinking water supplies or fish harvesting areas, especially for stationary species such as shellfish.²⁶⁸ The EPA advises local regulatory agencies to exercise careful consideration when pollutants are “bioaccumulative, persistent, carcinogenic, mutagenic, or teratogenic.”²⁶⁹ The EPA recommends that denial of a mixing zone be considered for any discharge that contains a bioaccumulative pollutant.²⁷⁰ The issue of mixing zones for bioaccumulative and persistent pollutants was most recently approached in agency guidance to address pollution problems in the heavily industrialized Great Lakes region, following Congress’s adoption of section 118 of the CWA in 1987.²⁷¹ Section 118 of the CWA required the EPA to adopt the Great Lakes Guidance in 1995, which included the most stringent guidance provisions on mixing zones to date.²⁷²

The EPA predicated its Great Lakes Guidance decisions on the long retention time of waters in the Great Lakes System.²⁷³ The EPA recommended that as of March 23, 1997, no new mixing zones be authorized for bioaccumulative chemicals of concern (BCC) and that a phase-out begin for all existing BCC mixing zones leading to their elimination by March 23, 2007.²⁷⁴ In addition, it advised that all new

266. *See id.* at 4.

267. *See* EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-7.

268. *Id.* at 5-8.

269. *Id.*

270. *Id.* Bioaccumulation potential is calculated using three factors: (1) the chemical-specific bioconcentration factor which describes the degree to which the pollutant can be absorbed to a concentration higher than in the environment; “(2) the duration of the exposure; and (3) the concentration of the chemical in the receiving water.” *Id.* at 5-8.

271. *See* Clean Water Act, 33 U.S.C. § 1268(c)(2) (1994).

272. *See* Final Water Quality Guidance for the Great Lakes System, 60 Fed. Reg. 15,366 (Mar. 23, 1995).

273. *See id.* at 15,367.

274. Water Quality Standards, 40 C.F.R. § 132, app. F (Procedure 5)(E)(3)(a) (2000).

mixing zones be prohibited from extending beyond the point of discharge-induced mixing,²⁷⁵ with an upper limit size restriction on new mixing zones of twenty-five percent of the design flow of the receiving water.²⁷⁶ The EPA's recommendations for mixing zone restrictions in the Great Lakes were successfully challenged in part by the American Iron and Steel Institute.²⁷⁷

The nature of mixing zone regulations and how they function can be summarized through four principle characteristics. First, in numerous criteria and guidance documents, the EPA has defined mixing zones as allocated impact zones where discharges of effluent are initially diluted. Second, mixing zones owe their existence to the federal government's acceptance of a state or tribe's right to adopt dilution-related implementation policies within their WQS regulations and the EPA's prerogative to authorize oceanic mixing zones outside state-controlled territorial waters. Third, by virtue of their legal construction and application, mixing zone policies have been characterized by at least one court as effluent limitation mechanisms. Fourth, mixing zone dilution factors routinely legalize the discharge of pollutants at levels that exceed scientifically-determined acute and chronic aquatic life numeric criteria, or any more general narrative criteria necessary to protect human health and aquatic life. Therefore, mixing zones can be described as federally sanctioned WQS implementation policies adopted into state regulations to modify water quality-based effluent limits in specific discharge permits via the multiplication of WQS criteria by dilution factors, and as federally authorized pollution dilution zones applied to ocean discharge NPDES permits.²⁷⁸

In the day-to-day world of water pollution management, the definitions and applications of mixing zones vary significantly from state-to-state and sometimes permit-to-permit, often at the discretion of an individual regulator or permit writer. Mixing zones have also been defined in hydrological terms as the area where converging, dissimilar bodies of water are incompletely mixed.²⁷⁹ Mixing zones have been defined biologically to address toxicity to organisms that enter into, reside in, or consume from waters polluted at levels that

275. *Id.* § 132, app. F (Procedure 3)(D)(1).

276. *See id.* § 132, app. F (Procedure 3)(E)(5).

277. *Am. Iron and Steel Inst. v. EPA*, 115 F.3d 979 (1997).

278. *See* Telephone Conversation with Carla Fischer, Permit Staff, EPA, Region X (June 1999) (on file with author).

279. Water Quality Standards Regulation, 63 Fed. Reg. 36,742, 36,788 (July 7, 1998).

exceed otherwise applicable numeric criteria.²⁸⁰ Mixing zones have also been defined on the basis of their ability to impair designated beneficial uses.²⁸¹ Given the range of accepted mixing zone definitions and limited regulatory control imposed by the federal government, the degree of variation in mixing zone implementation by individual states is not surprising.

Despite the CWA's tepid support of the use of dilution to treat wastes, the states and the EPA consider mixing zone policies to be legitimate components of state WQS programs.²⁸² Although state-led management of water pollution control was transferred to federal authority by the 1972 amendments to the CWA, states still enjoy considerable latitude over the adoption of water quality standards and therefore over the nature and implementation of mixing zone regulations.²⁸³ State responsibility for the authorization of mixing zones was reinforced in a 1996 EPA Office of Water memorandum reminding states to explicitly indicate in their WQS submissions whether mixing zones were to be allowed in state waters.²⁸⁴ Nonetheless, the EPA is ultimately required under the CWA to review all state-adopted water quality standards and implementation policies, including mixing zone regulations, to assure consistency between such standards and the policies, goals, purposes, and procedures of the CWA.²⁸⁵

As described previously, NPDES permits require that dischargers meet the more stringent of either technology-based effluent limits (when they exist) or water quality-based effluent limits (WQBEL) for each pollutant released. States that have adopted mixing zone policies are permitted to use mixing zone dilution factors to adjust WQBEL limitations.²⁸⁶ If the modified WQBEL is less stringent than the technology-based limit, the latter is applied in the permit.²⁸⁷ The underlying federal rationale supporting the inclusion of mixing zones into NPDES permit calculations is embodied in the concept of protecting the ecology of the waterbody as a whole.²⁸⁸ This

280. *Id.*

281. *Id.*

282. See Houck, *supra* note 55, at 10,545.

283. See Fogarty, *supra* note 12, at 5.

284. See Memorandum from Robert Perciasepe, Assistant Administrator, EPA, to Water Program Directors, Regions I-X (Aug. 6, 1996) (on file with author).

285. See Clean Water Act, 33 U.S.C. § 1313(c)(1) (1994).

286. See Memorandum from Robert Perciasepe, *supra* note 284, at 5.

287. See *id.* at 3.

288. See EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-3.

philosophy has been reiterated in every federal criteria manual since the Green Book was drafted in 1968.²⁸⁹

Although significant internal inconsistencies regarding mixing zone policy can be demonstrated within the Green, Blue, Red, and Gold Books, the EPA criteria manuals have remained mutually consistent throughout the years on the fundamental principles of mixing zone application. They agree on the importance of protecting fisheries resources and public health and welfare.²⁹⁰ They agree that some lowering of the nation's water quality is unavoidable.²⁹¹ They agree that the science of water quality is extremely complex.²⁹² They agree that mixing zones have a place in water quality regulation, and should be managed on a site-specific basis.²⁹³ This stability in EPA policy displays perhaps the most interesting fact about mixing zone application. EPA guidance and state regulations have remained remarkably consistent regarding the use of mixing zones for over three decades, despite the fact that during that time Congress dramatically altered the rules governing water pollution through the passage of, and amendments to, the Clean Water Act.

IV. MIXING ZONES IN ALASKA

A. *Alaska Law*

Alaska introduced its role as trustee over the waters of the state under title 46 of the Alaska State Statutes.²⁹⁴ The responsibility for administering this authority is assigned to the Alaska Department of Environmental Conservation (ADEC) in chapter 3, article 2, of title 46.²⁹⁵ This general authority is further defined to include the adoption of regulations necessary for the "control, prevention, and abatement, of air, water, or land, or subsurface land pollution."²⁹⁶ ADEC is permitted under article 3 to adopt WQS and determine what qualities

289. See, e.g., EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

290. See NAT'L ACAD. OF SCI., *supra* note 216, at 112-14; NAT'L TECH. ADVISORY COMM., *supra* note 53, at i.

291. See NAT'L ACAD. OF SCI., *supra* note 216, at 112; NAT'L TECH. ADVISORY COMM., *supra* note 53, at 31.

292. See NAT'L ACAD. OF SCI., *supra* note 216, at 231; NAT'L TECH. ADVISORY COMM., *supra* note 53, at 31.

293. See NAT'L ACAD. OF SCI., *supra* note 216, at 112; NAT'L TECH. ADVISORY COMM., *supra* note 53, at 31.

294. See ALASKA STAT. § 46 (1998).

295. *Id.* § 46.03.020.

296. *Id.* § 46.03.020 at 10(A).

or properties of water indicate a polluted condition actually or potentially deleterious to the beneficial uses of the water.²⁹⁷

Any person conducting an operation that results in the disposal of solid or liquid waste into state waters is required to procure a permit from ADEC before disposing of the waste material or wastewater.²⁹⁸ The requirement for a state discharge permit may be waived if the state has certified a NPDES permit drafted by the EPA for the discharge.²⁹⁹ Article 7 of the Alaska State Statutes under *Prohibited Acts and Penalties* provides that a “person may not pollute or add to the pollution of the air, land, subsurface land, or water of the state.”³⁰⁰ Although no mention is made in the statute of any opportunity for exceptions to article 7, discharges authorized through state or federal permitting programs are presumably exempt from this prohibition.

B. *Alaska Mixing Zone Regulations*

The following examination of the evolution of Alaska’s mixing zone regulation will provide insight into how states have adapted to the resumption of more vigorous water quality management by the federal government since the passage of the CWA. More specifically, the review will demonstrate how one state has used dilution factors through the application of mixing zones to maintain significant authority over pollution control and the protection of beneficial uses in waters within its borders.

The Alaska Department of Health and Welfare adopted the state’s first set of water quality regulations entitled *Water Quality Standards for Interstate Waters Within the State of Alaska and Plan for the Implementation and Enforcement of the Criteria* in June 1967.³⁰¹ The newly established standards adopted in response to the FWPCA amendments of 1965 were primarily concerned with the treatment of sewage. They also included, however, water quality criteria for eleven other pollution parameters.³⁰²

297. *Id.* § 46.03.070.

298. *Id.* § 46.03.100.

299. *Id.* § 46.03.110.

300. *Id.* § 46.03.710.

301. STATE OF ALASKA DEP’T OF HEALTH & WELFARE, WATER QUALITY STANDARDS FOR INTERSTATE WATERS WITHIN THE STATE OF ALASKA AND PLAN FOR THE IMPLEMENTATION AND ENFORCEMENT OF THE CRITERIA (June 1967).

302. *Id.* at Table. The eleven criteria are: dissolved oxygen; pH; turbidity; temperature; dissolved inorganic substances; residues (oils, solids, sludge); sediments; toxic and other deleterious substances; color; radioactivity; and aesthetic considerations.

The most remarkable aspect of the water quality standards was a statement addressing the application of pollution limits maintaining that “[e]nforcement will be based on samples essentially representative of the receiving water and not upon samples taken immediately adjacent to an outfall.”³⁰³ The state clearly established that compliance with the water quality standards was not to be evaluated at the end of the pipe, thereby creating a de facto mixing zone for every enforceable parameter in every waterbody in the state. These water quality standards predated the CWA and the NPDES program by approximately five years.³⁰⁴ Not surprisingly, they did not directly or indirectly presume to prohibit the discharge of wastes into waters of the United States.³⁰⁵

In July of 1970, still two years before the adoption of the CWA, the Alaska Department of Health and Welfare adopted revisions to the 1967 water quality standards.³⁰⁶ While these water quality standards continued to recognize the right of the state to authorize the discharge of wastes into public waters they also established the state’s intent to protect the uses designated for every waterbody by pollutant type. Alaska delineated these uses in the policy statement of the first WQS regulation:

It is the public policy of the state to maintain reasonable standards or purity of the waters of the state consistent with public health and public enjoyment, the propagation and protection of fish and wild life, including birds, mammals, and other terrestrial and aquatic life, and the industrial development of the state, and to require the use of all known available and reasonable methods to prevent and control the pollution of the waters of the state.³⁰⁷

303. *Id.* at 5.

304. *See id.*

305. *See id.*

306. ALASKA ADMIN. CODE tit. 7, §§ 70.010-70.070 (July 1970). The regulations primarily established: (1) that the water quality standards were to apply to all state waters; (2) the use classifications which would exist in state waters; (3) that the protection of the highest use for any given water would prevail; (4) that natural conditions of waters could influence otherwise applicable standards; (5) that the discharge of wastes into waters required permits; and (6) a table containing narrative and numeric criteria for conventional and toxic pollutants.

307. STATE OF ALASKA DEP’T OF HEALTH & WELFARE, *supra* note 301, at 5. The use category protecting the propagation of fish and other aquatic life is of particular interest, providing some of the most stringent criteria in Alaska regulations. Within that category, under the standard for *Residues: Oils and Floating Solids, Sludge Deposits*, discharges were prohibited from making the water “unfit or unsafe.” *Id.* tbl. (D)(7). Under *Sediment*, the standard declared the state’s unwillingness to accept any “appreciable deposition which (sic) adversely affects fish spawning and habitat.” *Id.* tbl.(D)(8). Under *Toxic Substances*, pollution was to be “absent or below concentration affecting public health or the ecological balance.” *Id.* tbl.(D)(9). For many hydrocarbons the standard was zero discharge: “no waste oils, tars, greases, or animal fats are

Had it not been for the de facto mixing zone principle, pollution standards this strict would have been remarkable in a state whose economy was committed to the development of oil, timber, and minerals resources.³⁰⁸ The state's enforcement policy was entirely arbitrary, and Alaska adopted no guidance regarding the size, chemical specificity, toxicity limitations or potential locations for implementing the de facto mixing zone exemption.³⁰⁹ By virtue of this policy, the State of Alaska assumed the discretionary power to approve potentially egregious levels of pollution despite the superficial intent of the regulatory language to prohibit dischargers from negatively impacting public waters.³¹⁰

Alaska revised the 1970 water quality standards in January of 1973, after having previously readopted the standards without revision in 1971. The January 1973 water quality standards included an antidegradation policy (ADP) that prohibited the lowering of water quality without social or economic justification and required the continued protection of present and anticipated uses.³¹¹ Although the de facto mixing zone allowance in the 1970 regulation was not included in the 1973 WQS package per se, it remained in force because the enforcement and implementation policy that originally established the incorporation of dilution into state regulation was adopted by reference from the 1967 WQS.³¹²

The state published its next water quality standards package in October 1973.³¹³ This set of regulations contained the first occurrence of the term mixing zone. In section 70.030, *Procedure for Determining Water Quality Criteria*, a subsection (3) was added stating that "waste discharge permits will define a mixing zone outside of which violations of the criteria will be determined."³¹⁴ Narrative criteria found under subsection 3 of the regulations specified that waste discharges shall "not diminish other beneficial

permitted." *Id.* tbl.(D)(7). Similarly, for the use category "shellfish growth and propagation," under the section *Toxic and Deleterious Substances*, discharges were not permitted to exceed either chronic or acute "problem levels," defined as toxicity criteria determined by laboratory testing. *See id.* tbl.(E)(9). Similarly, under the section *Dissolved Inorganic Substances*, the standard stated that chronic toxicity must be avoided. *See id.* tbl. (D)(6)5.

308. *See id.* at 5.

309. *See* ALASKA ADMIN. CODE tit. 7, § 70.070 (July 1970).

310. *See id.*

311. *Id.* tit. 18, § 70.010(b) (Jan. 1973).

312. *See id.* § 70.090.

313. *Id.* tit. 18, § 70 (Oct. 1973).

314. *Id.* § 70.030(3).

uses disproportionately” or “interfere with biological communities or populations of important species.”³¹⁵

This first, formally adopted policy authorizing mixing zones reiterated the state’s assumption that WQS could be routinely exceeded in portions of public waters.³¹⁶ However, the policy adopted under subsection 3 directly contradicted other portions of the regulations. For example, section 70.030 prohibited the discharge of dissolved inorganic substances, oils, floating solids, and sludge deposits, and toxic or other deleterious substances at levels resulting in chronic toxicity for the protected uses “growth and propagation of fish”³¹⁷ and “shellfish growth and propagation.”³¹⁸ The mixing zone policy also directly contradicted the opening policy statement of the WQS regulation, which declared that “[t]he water quality standards set forth in this chapter apply to *all* waters of the State.”³¹⁹ An antidegradation policy was adopted in the same regulatory package which prohibited the lowering of water quality to a point where “present and anticipated use[s]” of the waters would be precluded.³²⁰ Yet by virtue of the state’s enforcement policy, once a mixing zone was granted, all other applicable water quality standards and protection of uses could be waived by ADEC.³²¹

Viewed within the context of the changes in federal law occurring at the time, the transformation of the state’s mixing zone regulation between January 1973 and October 1973 is quite remarkable. Recall that the 1970 Alaska water quality standards regulation assumed that a dilution factor would be provided to all dischargers.³²² This was reasonable given that state and federal perspectives prior to the CWA viewed the dilution of wastes as a legitimate use of the nation’s waters.³²³ But the October 1973 Alaska regulation, which for the first time expressly provided for mixing zones, was adopted seven months *after* the federal government passed the CWA and challenged the continued use of the nation’s waters for the dilution of wastes.³²⁴

315. *Id.* § 70.030. No qualifications or definitions were provided for the terms “disproportionately” and “important”; narrative protections offered under subsection 3 were therefore to be determined arbitrarily. *See id.*

316. *See id.* § 70.030.

317. *Id.* § 70.020(D)(6)-(D)(7), (D)(9).

318. *Id.* § 70.020(E)(6)-(E)(7), (E)(9).

319. *Id.* § 70.010(a) (emphasis added).

320. *Id.* § 70.010(b).

321. *See id.*

322. *Id.* tit. 7, § 70.070 (July 1970).

323. *See* Water Pollution Control Act, Pub. L. No. 80-845, 62 Stat. 1155, § 5(a) (1948).

324. *See* ALASKA ADMIN. CODE tit. 18, § 70 (Oct. 1973).

In April 1979, the Alaska water quality regulation for mixing zones was expanded in an attempt to place sideboards on its use.³²⁵ The new regulation included policies addressing mixing zone size and configuration, and prohibited mixing zones for substances that could bioaccumulate in food chains; concentrate in sediments; persist in the environment; act in a carcinogenic, mutagenic, teratogenic manner; or form a barrier to the migratory routes of aquatic species.³²⁶

Significant inconsistencies between the new mixing zone policy and the state's other water quality regulations were still apparent under the April 1979 revisions. The ADP still required that natural water quality higher than necessary to protect established uses be maintained, except when a short-term variance or a reclassification had been authorized or where social or economic justification for the lowering of water quality had been approved.³²⁷ The ADP also required that present or potential uses of the water continued to be protected, even though beneficial uses could seemingly be removed in some areas through the use of mixing zones.³²⁸ Furthermore, the 1979 Alaska water quality standards still required discharges not to exceed chronic aquatic life criteria, even though exceeding such criteria directly resulted from most, if not all, mixing zone authorizations.³²⁹

The 1979 WQS also adopted a specific procedure for permanently reclassifying the uses of state waters, notwithstanding the fact that mixing zones had been employed since 1967 to remove use protections in portions of public waters.³³⁰ The new regulation stated that a reclassification of state waters, i.e., the removal or addition of protected uses, could be accomplished through a reclassification procedure established in that section.³³¹ This created another internal conflict between mixing zone policies and other WQS regulations. Perhaps ADEC believed that mixing zone reclassifications were distinct because of their impermanent nature, since discharge permits under the NPDES program must be renewed every five years.³³² However, given that Alaska's policy allowed mixing zones for virtually any discharge and allowed them to be regularly renewed, for all practical purposes mixing zones

325. *See id.* tit. 18, § 70 (Apr. 1979).

326. *Id.* § 70.032(a), (c)-(d).

327. *Id.* § 70.010(c).

328. *See id.*

329. *See id.* § 70.020(a)(1)(C).

330. *See id.* § 70.055.

331. *Id.* § 70.055(j).

332. *See* Clean Water Act, 33 U.S.C. § 1342 (b)(1)(B) (1994).

permanently removed uses without deference to the reclassification procedure.³³³

The next significant change in the mixing zone regulation occurred in Alaska's July 1985 amendments.³³⁴ The explicit prohibition adopted in 1979 against the discharge of bioaccumulative, persistent toxics, including those substances known to be carcinogenic, mutagenic, or teratogenic into mixing zones was substantially weakened by the addition of the conditional phrase "if . . . there is significant potential for adverse environmental or health effects."³³⁵ The terms "significant potential" and "adverse effects" were not quantified or defined.³³⁶

By 1987 Alaska had realized, or at least suspected, that its antidegradation policy was inconsistent with its mixing zone policy.³³⁷ This was remedied to the state's satisfaction by the 1987 WQS revisions, which clarified that the ADP did not apply to waters for which mixing zones had been approved by the department.³³⁸ The state's action was accepted by the EPA despite the fact that federal law required the state's ADP to be consistent with federal policy, and that federal policy contained no such exemptions for waters due to the presence of a mixing zone.³³⁹

The mixing zone regulation was revised yet again in October 1988.³⁴⁰ Three significant changes were adopted. First, the phrase "significant potential for adverse effects," which had previously weakened the regulation regarding the use of mixing zones for bioaccumulative, persistent, carcinogenic, mutagenic, and teratogenic substances, was removed.³⁴¹ Second, the prohibition against mixing zones forming barriers to migratory species was expanded to prohibit any adverse impacts on anadromous fish spawning or rearing.³⁴² Finally, the 1988 mixing zone regulation dropped all previous numeric criteria for mixing zones in fresh waters other than lakes.³⁴³ Although size restrictions based on percentages of the width of the

333. See ALASKA ADMIN. CODE tit. 18, § 70.032(a) (Apr. 1979).

334. See *id.* tit. 18, § 70 (July 1985).

335. *Id.* § 70.032(a)(1).

336. *Id.*

337. See *id.* tit. 18, § 70 (Aug. 1987).

338. See *id.* § 70.010(c)(2).

339. See Clean Water Act, 33 U.S.C. § 1313(d)(4)(B) (1994).

340. ALASKA ADMIN. CODE tit. 18, § 70 (Oct. 1988).

341. 33 U.S.C. § 1313(c)(2)(B). Perhaps ADEC had been influenced by the 1987 readoption of the CWA, which was strengthened by Congress in the area of toxics control. See *id.* § 1313(c)(2)(B).

342. ALASKA ADMIN. CODE tit. 18, § 70.236 (b) (Oct. 1988).

343. *Id.* tit. 18, § 70.236(b) (Oct. 1988).

waterbody were fundamentally arbitrary and could not guarantee compliance with state water quality standards they were nonetheless retained only for marine waters, coastal waters, and lakes. Some regulatory control of mixing zones in fresh waters other than lakes was retained, but it was strictly narrative in nature.

One other change in the 1988 revisions also occurred. The new regulation required the state to “ensure that other water uses are protected” when it determined whether the application of a mixing zone was or was not appropriate.³⁴⁴ Taken literally, this wording could imply that despite federal laws and regulations prohibiting the establishment of waste assimilation as a designated use, the state could consider the assimilation of wastes within a mixing zone to be a “use.”³⁴⁵ An alternative interpretation is that the poorly worded language merely affirmed the state’s commitment to protect uses in waters outside mixing zones. Either interpretation would however appear to conflict with the federal antidegradation policy, which prohibits the removal of existing uses in all waters.³⁴⁶

The Alaska WQS regulations were revised again in April 1996.³⁴⁷ The 1996 regulations rescinded the prohibition against discharging bioaccumulative and persistent substances in mixing zones, restating qualifying language requiring a demonstration that pollutants could bioaccumulate, be persistent above natural levels in sediments or water, or be capable of adversely impacting biota.³⁴⁸ Once again carcinogens and mutagens could be diluted in mixing zones provided that “significant human health risks” were not “expected” to occur.³⁴⁹

Alaska now allowed the water quality standards for particular chemicals in mixing zones to exceed acute aquatic life criteria.³⁵⁰ Following the EPA’s mixing zone recommendations articulated in the TSD, ADEC introduced the ZID to Alaska.³⁵¹ As described previously, a ZID is a smaller-diameter mixing zone for initial dilution permitted to exceed acute and chronic criteria, while a second, larger-diameter mixing zone exceeds chronic aquatic life criteria and human health criteria.³⁵²

344. *Id.* § 70.032(c).

345. *See* Water Quality Standards, 40 C.F.R. § 131.10(a) (2000).

346. *See id.* § 131.12.

347. ALASKA ADMIN. CODE tit. 18, § 70 (Apr. 1996).

348. *Id.* § 70.032(a)(1)(A).

349. *Id.* § 70.032(a)(1)(B).

350. *Id.* § 70.032(b).

351. *See* EPA, TECHNICAL SUPPORT DOCUMENT, *supra* note 52, at 33.

352. *Id.*

The EPA's "waterbody-as-a-whole" concept was incorporated into Alaska's WQS in 1996, and the 1996 revisions introduced the stipulation that pollution treatment methods required by the department would have to be economically feasible for the discharger.³⁵³ Finally, in addition to adding specific language describing the methods of calculating mixing zone size and volume parameters, a description of mixing zone use in streams and rivers was reinstated, along with a subsection specifically prohibiting the authorization of mixing zones in fish spawning areas.³⁵⁴

Alaska adopted a mixing zone regulation containing few policy changes but significant internal restructuring in April 1998. The only substantial change in policy from the 1996 regulation was a rescission of the prohibition against mixing zones in anadromous waters.³⁵⁵ ADEC regulation reverted to previous regulatory language that prohibited such mixing zones only if they were expected to create adverse impacts.³⁵⁶

C. Alaska Mixing Zone Applications

In this Part, the most significant industrial mixing zones currently authorized in the state are examined to demonstrate the application of mixing zones in Alaska since the passage of the Act. Few detailed mixing zone determinations were found in ADEC records prior to the past decade.³⁵⁷ This relative scarcity of determinations probably exists because effluent dilution had been permitted in the state since the initial adoption of WQS in 1968, and as a result, ADEC regulators had adopted a *laissez-faire* policy regarding mixing zones.³⁵⁸ According to ADEC, a simple application of dilution factors rather than a detailed treatment or investigation into the characteristics or possible effects of the sanctioned mixing zone

353. ALASKA ADMIN. CODE § 70.032(c), 70.032(d)(2) (Apr. 1996).

354. *Id.* § 70.032(f)(3)(A)-(B), (D).

355. *See id.* tit. 18, § 70 (Apr. 1998).

356. *Id.* § 70.250(a)(2)(A).

357. Many of the permits containing mixing zones in Alaska have been issued for municipal sewage treatment facilities. *See, e.g.*, EPA NPDES Permit No. AK-0022497 (Sept. 2000); EPA NPDES Permit No. AK-0047856 (Oct. 2000); EPA NPDES Permit No. AK-002003-6 (June 2000). These mixing zones are primarily concerned with the dilution of conventional pollutants (i.e., fecal coliform bacteria, suspended solids, and biological oxygen demand). *See* EPA NPDES Permit No. AK-002003-6, at 4. The most significant exception is the Anchorage Municipal Treatment Plant at Point Worenzof, Alaska, which accepts wastestreams from a number of industrial dischargers in addition to receiving the domestic wastewater of most residents within the city of Anchorage. *See id.*

358. *See* STATE OF ALASKA DEP'T OF HEALTH & WELFARE, *supra* note 301, at 5.

was used to adjust the WQBEL in permits prior to the late 1980s.³⁵⁹ The incorporation of site-specific considerations reflecting either the physical characteristics of the waterbody, the nature of the pollutant, or the potential short-term or long-term downstream impacts of the discharge is generally left to the discretion of the permit writer.³⁶⁰

In the late 1980s the state adopted a more rigorous approach to the assignment of mixing zones. One of the first detailed industrial mixing zone evaluations was prepared for the oil and gas producers in Cook Inlet in 1986.³⁶¹ Two of the facilities covered under the permit, located at Granite Point and Trading Bay, challenged the mixing zone allowances drafted by the State in federal court.³⁶² The circumstances surrounding those mixing zone determinations are reviewed in Part V.C. Four other mixing zones for industrial discharges are described below.

D. Alyeska Ballast Water Treatment Facility

The Ballast Water Treatment Facility (BWTF), located at the end of the Trans-Alaska Pipeline in Valdez, regularly receives millions of gallons of ballast water from oil tankers returning to Alaska to pick up crude oil shipments for delivery to refineries primarily along the western coast of the United States.³⁶³ The BWTF received its first NPDES permit in 1974, and has had its discharge permit reissued in 1980, 1989, and 1996.³⁶⁴ The BWTF treats the ballast water to remove petroleum hydrocarbons before it is discharged into Port Valdez.³⁶⁵ The BWTF treats and releases a maximum of twenty

359. See Telephone Conversation with Pete McGee, State of Alaska Department of Environmental Conservation (July 14, 1999) (on file with author). The state's current process for establishing mixing zones can be summarized as follows: (1) the technology-based standard (if one exists) is identified for each pollutant based on the category of the discharge; (2) the state WQS for the parameter is identified and a determination is made as to which of the two standards (water quality or technology-based), is more stringent for the pollutant; (3) if the WQS would be the controlling factor for the level of discharge, and the pollutant concentration in the effluent is expected to exceed the WQS, ADEC determines the volume of water needed to dilute the discharge to the WQS; (4) if the receiving water is large enough to provide the necessary dilution, the dilution factor is incorporated into the calculation of a WQBEL; and (5) the more stringent of either the technology-based limit or the WQBEL is entered into the permit as the effluent limitation for that pollutant. See *id.*

360. See ALASKA ADMIN. CODE tit. 18, §§ 70.245, 70.250 (2000).

361. See EPA NPDES Permit No. AKG-285000 (Oct. 1986).

362. *Marathon Oil Co. v. EPA*, 830 F.2d 1346 (5th Cir. 1987).

363. *Alyeska Pipeline Serv. Co. v. EPA*, 856 F.2d 309, 310 (D.C. Cir. 1988).

364. EPA NPDES Permit No. AK-002324-8 (July 1996).

365. *Id.*

million gallons of treated ballast water per day under a NPDES permit drafted by the EPA and certified by the state of Alaska.³⁶⁶

The BWTF permit incorporates mixing zones designed for acute and chronic aquatic life criteria, and human health parameters related to the release of the "BTEX" hydrocarbons (benzene, toluene, ethylbenzene, and xylene) at its main outfall.³⁶⁷ The permit also includes a mixing zone for the facility's sewage discharge (at a secondary outfall) which exceeds the state's WQS for total suspended solids.³⁶⁸ The BTEX hydrocarbons are listed by the EPA under section 1314 of the CWA as toxic chemicals;³⁶⁹ the suspended solids are regulated as a conventional pollutant.³⁷⁰

The first BWTF mixing zone derived with any semblance of a scientific rationale was included in the facility's 1989 NPDES permit renewal. The permitted mixing zone encompassed 141 acres in Port Valdez. In 1997 the permit was reissued with a smaller mixing zone of 108 acres. Assuming an average waterbody depth within the mixing area of 140 feet, the current chronic toxicity mixing zone extends throughout a volume of water in Port Valdez of five billion gallons of seawater.³⁷¹

The acute aquatic life criteria mixing zone for BTEX is restricted to a region no greater than fifty feet from the diffuser at Outfall 001.³⁷² Based on computer modeling, dye studies, and BTEX test data, ADEC concluded that a minimum dilution ratio at the edge of this fifty-foot boundary would be 100:1.³⁷³ The human health and chronic aquatic life mixing zone boundary for Outfall 001, in addition to the horizontal boundary of 108 acres, was set to restrict the mixing zone from encroaching upon the upper photic zone, or the uppermost forty-six feet of the water column.³⁷⁴ Based on computer modeling, ADEC concluded that the dilution ratio at the edge of the photic zone would be at minimum 38:1.³⁷⁵ The mixing zone at the Sanitary Wastes Outfall 002 was defined as a cylinder with a radius of thirty-three feet,

366. *Id.*

367. *Id.* at 5.

368. *Id.* at 10.

369. 63 Fed. Reg. 67,548, 67,551 (Dec. 7, 1998).

370. Clean Water Act, 33 U.S.C. § 1314(a)(4) (1977).

371. See Telephone Conversation with Joseph Bridgeman, Prince William Sound Regional Citizen's Advisory Council (Jan. 1999) (on file with author).

372. EPA NPDES Permit No. AK-002324-8, at 5.

373. EPA NPDES Permit No. AK-002324-8, Preliminary 401 Certification, at 2 (July 1996).

374. *Id.*

375. *Id.*

and computer modeling by ADEC concluded that the dilution ratio at the mixing zone boundary would exceed 600:1.³⁷⁶

The 1996 permit renewal issued by ADEC for Outfall 001 reduced the mixing zone allocation by twenty-three percent from that permitted in 1989.³⁷⁷ According to ADEC, the installation of improved biological treatment ponds during the previous permit cycle significantly improved the performance of the BWTF and allowed the permit to include a more stringent effluent limitation.³⁷⁸ The agency further cited the facility's discharge-monitoring reports to demonstrate that the WQS for the BTEX hydrocarbons (without any dilution factor) were being routinely met at the end of the pipe.³⁷⁹ However, problems with the bacterial digestion system or a maintenance shutdown of a wastewater treatment tank at the BWTF occasionally result in WQS not being met at the end of the pipe.³⁸⁰ In those instances, the conservative size of the mixing zone provides regulatory flexibility so that permit violations do not occur.³⁸¹ ADEC believes that even during those times when the mixing zone is necessary to modify the applicable WQS, the beneficial uses of the waterbody are not impaired.³⁸²

Permit limit monitoring is achieved through sampling at the treatment facility. Impacts from the discharge are determined through "whole effluent toxicity testing" (WET), and benthic abundance and community structure studies.³⁸³ The Prince William Sound Regional Citizen's Advisory Council has recently begun investigating the increased use of *in situ* bioassays (caged bivalve studies) as a mechanism to more accurately determine the impacts of the discharge on the biota in Port Valdez.³⁸⁴

E. Greens Creek Lead-Zinc Mine

The Greens Creek Lead-Zinc Mine is located adjacent to Hawk Inlet on Admiralty Island in Southeast Alaska, within the boundaries of the Admiralty Island National Monument. The mine was first

376. *Id.*

377. *Id.*

378. See Telephone Conversation with J. Kitagawa, Environmental Specialist III, ADEC, Office of Air and Water Quality (July 1999) (on file with author).

379. *See id.*

380. *See id.*

381. *See id.*

382. See Letter from R. Kiehl, ADEC, Letter No. 96-018-RK, File No. 1200.46.022 (July 1996).

383. See EPA NPDES Permit No. AK-002324-8, at 19, 26 (July 1996).

384. See Telephone Conversation with Joseph Bridgeman, *supra* note 371.

issued a NPDES permit in 1987; production commenced in 1989.³⁸⁵ The company submitted an application for renewal of its NPDES permit in 1995, even though the mine had been closed since 1993 due to low prices for metals in the world market.³⁸⁶ The renewal process was delayed several years by the federal government because Alaska had failed to adopt human health criteria for toxic substances as required under the National Toxics Rule (NTR).³⁸⁷ The NTR forced Alaska to adopt federal toxics criteria by reference into the state's WQS.³⁸⁸

One of the toxic substances for which Alaska had to adopt federal criteria as a result of the NTR was arsenic.³⁸⁹ Many mineralized areas in Alaska, particularly in Southeast Alaska, have very high natural background levels of arsenic.³⁹⁰ The combination of a high background concentration of arsenic in Hawk Inlet seawater and the allowable ambient concentration stipulated under the NTR precluded the possibility of a permit to discharge additional arsenic into Hawk Inlet.³⁹¹ This hurdle stalled the permit process since NPDES permits are required to contain limits that will lead to the attainment of WQS. The mine's arsenic problem, coupled with the weak price of metals, resulted in the mine's closure until 1996.³⁹²

ADEC petitioned the EPA to remove Alaska from the NTR arsenic restriction in May 1996 and raise the state's arsenic standard from the NTR human health standard of 1.36 micrograms/liter to the Food and Drug Administration's 50 micrograms/liter standard for drinking water.³⁹³ The EPA agreed to raise the limit as requested in 1998. Thus the permit renewal process was restarted because the mine's discharge no longer exceeded the applicable arsenic criteria. A final permit was completed later that year.³⁹⁴

The mine has two effluent discharge points.³⁹⁵ Outfall 001 discharges conventional and nonconventional pollutants resulting from the treatment of sanitary wastes.³⁹⁶ Outfall 002 releases

385. See EPA NPDES Permit No. AK-004320-6, Fact Sheet at 4 (Mar. 1998).

386. See *id.* at 4, 7.

387. See 57 Fed. Reg. 60,848, 60,862 (Dec. 22, 1992).

388. See *id.* at 60,876.

389. See Letter from Michele Brown, Commissioner, ADEC, to Chuck Clark, Regional Administrator, EPA (May 31, 1996) (on file with the *Tulane Environmental Law Journal*).

390. See *id.*

391. See *id.*

392. See EPA NPDES Permit No. AK-004320-6, Fact Sheet at 7 (Mar. 1998).

393. See Brown, *supra* note 389, at 1.

394. EPA NPDES Permit No. AK-004320-6, Fact Sheet at 4 (Oct. 1998).

395. *Id.*

396. *Id.*

conventional, nonconventional, and toxic compounds related to the extraction of the ore.³⁹⁷ Inputs to the Outfall 002 discharge pipe include underground mine waters, mill wastewater, runoff from the marine facilities, some domestic wastewater, and seepage and runoff from the “dry” tailings pile (ten percent water by weight) and waste rock storage sites.³⁹⁸ The original permit contained a mixing zone for Outfall 002 that measured 600 feet by 1000 feet.³⁹⁹ As noted previously, few mixing zone determinations established by ADEC in the 1980s were analytically rigorous.⁴⁰⁰ The original Greens Creek mixing zone was not one of the more rigorous applications. ADEC redesigned the mixing zone in the 1998 permit with the state’s “small as practicable” provision in mind, and permitted the mixing zone to be 100 feet by 300 feet in size.⁴⁰¹ This reduction in allowable size was aided in part by the company’s installation of an improved treatment system during the period of mine closure.⁴⁰²

ADEC and the EPA determined that lead required the largest dilution factor of all discharge constituents.⁴⁰³ The mixing zone for the 1998 permit was modeled using two dilution models (“PLUMES” and “CORMIX”), and the agencies determined that a 170:1 dilution factor would bring the lead discharge into compliance.⁴⁰⁴ Alaska’s WQS initially stipulated stricter concentration limits than the technology-based standards for most of the metals in the discharge.⁴⁰⁵ However, after the application of the 170:1 dilution factor to Outfall 002, the technology-based standards became more stringent for most pollutants and were applied to most constituents in the discharge.⁴⁰⁶ Since the 170:1 dilution volume exceeded the volume needed for all parameters other than lead to meet the WQS, ADEC assumed that all other constituents of the discharge would meet their respective WQS by the edge of the mixing zone. Outfall 001 was assigned a mixing

397. *Id.*

398. *Id.*

399. See Telephone Conversation with Sharman Stambaugh, ADEC (July 19, 1999) (on file with author).

400. See text accompanying *supra* notes 357-360.

401. See ALASKA ADMIN CODE tit. 18, § 70.240(a)(2) (Oct. 1988).

402. See EPA NPDES Permit No. AK-004320-6, at 7. ADEC anticipates that the new treatment system will also significantly decrease the number of excursions from the permit parameters. See Stambaugh, *supra* note 399. In 1989, Greens Creek was found guilty of 116 violations of metals and pH limits and fined \$50,000. See EPA NPDES Permit No. AK-004320-6, at 7. From 1991-1995, the mine violated water quality standards 259 times for metals and pH standards and was required to pay an additional \$300,000 in penalties. See *id.*

403. See EPA NPDES Permit No. AK-004320-6, Fact Sheet at 13.

404. See *id.*

405. See *id.* at 13.

406. See *id.*

zone of approximately 328 feet to provide a dilution factor of 500:1 for the sanitary waste discharge.⁴⁰⁷ The mixing zone diluting capacity of the discharges from both outfalls are monitored directly and in the water column adjacent to the outfall pipes.⁴⁰⁸ Additional monitoring of metals accumulation is performed in sediments nearby Outfall 002, the ore-loading facility, and the ship berth.⁴⁰⁹ The discharge from Outfall 002 undergoes WET testing for cumulative chronic toxicity, and several sites are identified in the permit for regular *in situ* bioassays to determine the body burden of resident organisms.⁴¹⁰

As noted earlier, the Alaska WQS mixing zone regulations contain language that may restrict the size of a mixing zone based solely on cross-sectional dimensions of the waterbody.⁴¹¹ In general this limitation results in mixing zones that do not exceed ten percent of the total length of the appropriate cross-section.⁴¹² In this case the ten percent rule was waived, as permitted under state regulation if ADEC finds that the increased size limitation can be accommodated without compromising the safety and uses of the entire waterbody.⁴¹³

F. *Alaska Placer Miner General Permit*

Placer mining operations in Alaska have the potential to significantly impact water quality because metals and suspended sediments (measured as turbidity) can be released into the receiving waters in large quantities by the sluicing process.⁴¹⁴ Sediments from placer mining discharges can physically damage fish spawning and rearing habitat, and elevated levels of metals can be toxic to fish and interfere with their ability to return to their parent streams.⁴¹⁵ Permitting, monitoring and enforcement of the industry has been traditionally weak and contentious, resulting in several lawsuits over permit limitations for turbidity and arsenic.⁴¹⁶

The EPA issued a general permit for placer mining in Alaska in May 1994.⁴¹⁷ The move to a general permit resulted from the

407. *Id.* at 15.

408. *See id.* at 17.

409. *See id.* at 19.

410. *See id.* at 17.

411. *See* ALASKA ADMIN. CODE tit. 18, § 70.255(e)(1)(A) (2000).

412. *See id.*

413. *Id.* tit. 18, § 70.255(e).

414. *See* EPA NPDES Permit No. AKG-37-0000, Fact Sheet at 18 (2000).

415. *See id.*

416. *See* *Ackels v. EPA*, 7 F.3d 862 (9th Cir. 1993); *Trustees for Alaska v. EPA*, 749 F.2d 549 (9th Cir. 1984).

417. *See* EPA NPDES Permit No. AKG-37-0000 (1994).

agency's desire to consolidate the permitting process which had required the issuance of hundreds of individual permits, and to increase the overall consistency of monitoring and control procedures.⁴¹⁸ Public interest groups saw the issuance of the general permit as an opportunity to raise numerous longstanding issues of concern related to the lack of control on metals discharges, inadequate monitoring and enforcement, and circumvention of the state's mixing zone regulation.⁴¹⁹ Individual permits issued prior to 1994 contained a limitation that simply permitted turbidity to be measured at a point downstream from the discharge.⁴²⁰ Without application of the formal mixing zone process there was little to no modeling or site-specific characterization of impacted streams, and essentially no public involvement.⁴²¹ Several public interest groups considered the general permit to be significantly flawed despite improvements over the previous individual permits.⁴²² The general permit was subsequently challenged in the United States Court of Appeals for the Ninth Circuit, and a settlement agreement ending the litigation was reached in 1996.⁴²³ The settlement stipulated undertaking studies on metal concentrations downstream from the mines, and the effects of suction dredging.⁴²⁴ The revised permit now contains an effluent limitation for turbidity that allows a mixing zone to be developed upon request by individual operators.⁴²⁵ Data has been compiled on the industry's performance under the revised 1996 permit. Results of the studies on metal concentrations and suction dredging disclosed a need for improved regulations for the discharges of metals from placer mining activities.⁴²⁶

418. *See id.*

419. *See* Telephone Conversation with Eric Jorgensen, Managing Attorney, Earthjustice Legal Defense Fund, Alaska Office (July 1999) (on file with author).

420. *See id.*

421. *See id.*

422. *See* EPA NPDES Permit No. AKG-37-0000, Fact Sheet at 8-9 (2000).

423. *See id.*

424. *See id.* at 9.

425. *Id.* at 13. The state WQS for turbidity of five nephelometric turbidity units or NTU can be modified by a mixing zone provided that: (1) a level of 1500 NTU is not exceeded; (2) turbidity levels do not exceed 100 NTU in at least one half of the cross-sectional area of resident and anadromous fish migration corridors; (3) complete mixing at the edge of the mixing zone takes place using a ten-year, thirty-day low flow assumption with an upstream turbidity value of zero; (4) the mixing zone does not occur in an area of anadromous fish spawning and rearing; and (5) public notification and an opportunity to comment is provided on every mixing zone application. *See* Settlement Agreement, Alaska Placer Miner General NPDES Permit No. AKG-37-0000 (9th Cir.) (No. 94-70613).

426. *See* Telephone Conversation with Eric Jorgensen, Managing Attorney, Earth Justice Legal Defense Fund, Alaska Office (Jan. 26, 2001) (on file with author).

G. Cook Inlet General Permit for Oil Drilling

The EPA reissued a general permit for oil exploration and production facilities in Cook Inlet, Alaska, in April 1999, replacing the general permit issued in 1986.⁴²⁷ As with their decision to issue a general permit for the placer mining industry, the EPA determined that the Cook Inlet facilities would be more appropriately controlled by a general permit rather than by individual permits.⁴²⁸ Five of the eight oil and gas-producing facilities covered under the general permit are floating platforms and three are shore-based facilities.⁴²⁹ Drilling muds and cuttings are the major pollutants discharged from the exploratory and development drilling operations.⁴³⁰ Produced water and well treatment fluids are the major pollutant sources discharged from production operations.⁴³¹ Pollutant classes included in the discharges encompass all three categories of pollutants: conventional, nonconventional, and toxic.⁴³² The 1986 general permit contained mixing zones for petroleum hydrocarbon discharges of produced water at all of the facilities now covered under the 1999 general permit.⁴³³ Mixing zones approved in the 1999 permit modify the limitations for metals, total aromatic hydrocarbons, total aqueous hydrocarbons, and toxicity.⁴³⁴ Included within this group are two human carcinogens, arsenic and benzene.⁴³⁵ In addition, the sanitary waste outfalls for the facilities have been granted mixing zones for residual chlorine.⁴³⁶

The mixing zones for the eight facilities vary significantly from one another on the basis of their location within the receiving water and the profiles of their specific discharges. The mixing zones for hydrocarbons are projected to be cylindrical in shape and range in size from twenty meters (65.6 feet) in radius from the outfall pipe at the

427. EPA NPDES Permit No. AKG-285000 (Feb. 1999).

428. See Alaska Outer Continental Shelf, 60 Fed. Reg. 48,796, 48,797 (Sept. 20, 1995).

429. *Id.* at 48,798.

430. *Id.*

431. *Id.*

432. *Id.* Conventional pollutants listed in the permit include pH, biological oxygen demand, oil and grease, total suspended solids, and fecal coliform. Nonconventional pollutants in the permit are chemical oxygen demand, toxicity, total organic carbon, salinity, temperature, and chlorine. The toxic pollutants listed in the permit are benzene, ethylbenzene, naphthalene, toluene, phenol, 2,4-dimethylphenol, bis (2-ethylhexyl) phthalate, anthracene, phenanthrene, and zinc. *Id.*

433. See *id.*

434. See *id.* at 48,801.

435. See *id.*

436. *Id.*

Tyonek A facility to 1420 meters (0.88 miles) in radius from the outfall pipe at the Trading Bay plant.⁴³⁷

The Granite Point mixing zone for hydrocarbons doubled its radius from the 1986 permit to the 1999 permit, which expanded the zone from 450 meters (0.28 miles) to 955 meters (0.59 miles).⁴³⁸ The Trading Bay mixing zone for hydrocarbons nearly doubled its radius as well, increasing from 750 meters (0.47 miles) to 1420 meters (0.88 miles).⁴³⁹ According to ADEC, these increases resulted from changes in mixing zone modeling software and changes in the state WQS.⁴⁴⁰

Part V.C below describes a lawsuit concerning the mixing zone derivations for the Granite Point and Trading Bay facilities. The mixing zones proposed (and upheld by the court) for those facilities in the 1986 permit required the company to extend the outfall pipes to insure that the discharge would always be submerged in a minimum of five meters of water.⁴⁴¹ The 1997 general permit perpetuated that requirement for those two facilities as well as for the other existing facilities.⁴⁴² Existing facilities are permitted to continue discharging at the five-meter (16.4 feet) isobath (a line connecting all points of equal depth below the surface of a body of water).⁴⁴³ New facilities covered by the general permit will be required to discharge, at minimum, seaward of the ten-meter (32.8 feet) isobath.⁴⁴⁴

Most permits in Alaska that incorporate mixing zone dilution factors consolidate the mixing zones into one zone based on the parameter requiring the most dilution.⁴⁴⁵ The Cook Inlet general permit is an exception to that practice. Separate mixing zones for hydrocarbons, metals, toxicity, and chlorine are all described in the permit, and routine sampling is performed for each parameter at each outfall to insure that the effluent limits based on the specific mixing zones are met.⁴⁴⁶ Of the produced water mixing zones covered under the general permit, only the Tyonek A facility required a much larger mixing zone diameter for metals (96 meters or 315 feet) and toxicity

437. EPA NPDES Permit No. AKG-285000, Attachment A (Feb. 1999).

438. *See id.*

439. *See id.*

440. *See* Telephone Conversation with Robert Dolan, ADEC, Division of Air and Water Quality (Aug. 1999) (on file with author).

441. *See* *Marathon Oil Co. v. EPA*, 830 F.2d 1346, 1355 (5th Cir. 1987).

442. EPA NPDES Permit No. AKG-285000, at 9 (Feb. 1999).

443. *Id.*

444. *Id.*

445. *See* Letter from Kenwyn George, ADEC, Office of Engineering and Technical Services, to Thomas Waldo, Staff Attorney, Earthjustice Legal Defense Fund (Dec. 26, 1997) (on file with the *Tulane Environmental Law Journal*).

446. *See* EPA NPDES Permit No. AKG-285000 (Feb. 1999).

(46 meters or 151 feet) than for hydrocarbons (20 meters or 66 feet).⁴⁴⁷ All other facilities included in the general permit required much larger mixing zones for their hydrocarbon discharges (ten to fifty times greater in diameter) than for either the metals or toxicity parameters to enable their hydrocarbon discharges to achieve Alaska's WQS.⁴⁴⁸ The distance in meters needed to achieve the required dilution is of course dependent upon the specific location of the outfall and the concentration of the pollutant in the wastestream.

Mixing zones are authorized in Alaska for everything from inorganic suspended particulate matter to Class A-carcinogens and range in size from a few feet to several miles in diameter.⁴⁴⁹ The state's first WQS regulations were adopted in 1967 to comply with the FWPCA revisions of 1965.⁴⁵⁰ They included a policy that allowed any polluted wastestream to be diluted in public waters by stating that pollution monitoring and enforcement would occur at some distance downstream from the point of discharge.⁴⁵¹ The first direct reference to the term mixing zone appeared in the October 1973 WQS revisions, adopted several months after the passage of the CWA.⁴⁵² Thereafter mixing zones were codified in a distinct subsection of the regulations.⁴⁵³ The State's mixing zone policy has been revised numerous times, and systematically expanded in scope and detail.

It should be noted that although the CWA requires states to hold public hearings and modify and adopt water quality standards as appropriate at least once every three years, Alaska failed to adopt revised water quality standards between 1989 and 1996.⁴⁵⁴ New regulations were drafted in 1992, but public reactions to the proposed regulations, which included weaker WQS for mixing zones, total dissolved solids, and petroleum hydrocarbons, and the adoption of weak criteria for several toxic substances including organochlorines and arsenic, greatly slowed the adoption process.⁴⁵⁵ A new administration elected in 1994 dropped some of the more

447. Parametrix Inc., *Mixing Zone Application for the Cook Inlet Oil and Gas Operators* (NPDES Permit No. AKG-285100) (Aug. 1995).

448. *Id.* at 1.

449. See STATE OF ALASKA DEP'T OF HEALTH & WELFARE, *supra* note 301, at 5.

450. See *id.*

451. See *id.*

452. See ALASKA ADMIN. CODE tit. 18, § 70.030 (Oct. 1973).

453. See *id.* tit. 18, § 70.032 (Apr. 1979).

454. See Clean Water Act, 33 U.S.C. § 1313(c)(1) (1977).

455. See Jeanne Cochran, Staff Attorney, Sierra Club Legal Defense Fund, *Comments On Proposed Revisions To Alaska's Water Quality Standards* (Nov. 1993) (on file with author).

controversial WQS proposals. The 1996 revisions, and in particular the mixing zone regulation, were considered by members of the public to be substantially weakened from the 1989 regulation.⁴⁵⁶

Aside from the 1989 revision that prohibited mixing zones for bioaccumulative, persistent, or carcinogenic chemicals, and the 1996 revision that banned mixing zones in anadromous waters, each successive change in the regulations increased the state's ability to permit mixing zones in public waters.⁴⁵⁷ The tightening provisions adopted in 1989 and 1996 were rescinded in subsequent regulation.⁴⁵⁸

While the documentation required for authorization of mixing zones has become more complex and time consuming for applicants over the years, the minimal criteria necessary to receive a mixing zone has remained achievable for nearly every discharger.⁴⁵⁹ Aside from basic considerations of receiving water volume and diluting capacity, there are no maximum size limitations and no prohibitions against mixing zone authorization for any category of pollutant in any class of waters.⁴⁶⁰ The critical factor in the determination of mixing zone appropriateness and size continues to rest with the state's self-evaluated ability to predict harm to the waterbody as a whole. Again, the definition of exactly what constitutes significant harm to the whole waterbody is left to the discretion of the state.⁴⁶¹ Provided that the uses of the greater waterbody are not expected to be precluded by a proposed discharge, the size of any mixing zone is simply the volume of receiving water necessary to offer the dilution factor needed to achieve the applicable WQS.⁴⁶²

According to ADEC, there are probably thousands of discharges in Alaska with de facto mixing zones, most of which are unregulated sewage discharges.⁴⁶³ Given the size of the state and the number of tiny, remote communities, it has been understandably difficult for ADEC to address every small sanitary waste discharge. A more successful effort has been made to regulate mixing zones for industrial discharges and the state's larger municipalities. There are approximately 800 mixing zones now in effect in those two

456. See Gershon Cohen, Executive Director, Alaska Clean Water Alliance, *Public Comment on the ADEC October 31st, 1996, Draft Mixing Zone Regulation* (Nov. 1996) (on file with author).

457. *Id.*

458. *Id.*

459. *Id.*

460. *Id.*

461. *Id.*

462. *Id.*

463. See Telephone Conversation with Pete McGee, *supra* note 359.

categories, of which 200 have been authorized for the placer mining industry, and approximately 400 authorized for operators in the seafood processing industry.⁴⁶⁴ In a few cases, recent permit renewals have incorporated smaller mixing zones because treatment methods were improved.⁴⁶⁵ At other locations, mixing zones have been significantly expanded in size.⁴⁶⁶ The placer mining general permit has authorized several mixing zones exceeding one mile in length, with one placer mining mixing zone reaching approximately three miles downstream.⁴⁶⁷ Prior to the general permit, de facto placer mining mixing zones, although rarely monitored, were restricted in regulation to a distance of 500 feet from the point of discharge.⁴⁶⁸

A significant degree of latitude exercised in mixing zone size determinations varies with the permit writer's interpretation of the phrase "small as practicable."⁴⁶⁹ The calculation of practicability is highly subjective, requiring the regulator to weigh various treatment options and determine the reasonableness of imposing the treatment on an individual operator who is permitted to submit an economic argument, demonstrating its ability (or inability) to afford the treatment protocol. When discharges contain more than one pollutant requiring a dilution factor to achieve WQS, the mixing zone boundary is often determined for the pollutant that needs the greatest dilution factor.⁴⁷⁰ The rationale is that all other pollutants will meet their respective WQS at or before that boundary. However, under this scenario nonforcing pollutants may receive larger mixing zones than they might have otherwise received had they been the driving factor for the overall mixing zone dimension. Alaska does not require acute

464. See Letter from Kenwyn George, *supra* note 445.

465. See, e.g., EPA NPDES Permit No. AK-002324-8 (July 1996); EPA NPDES Permit No. AK-004320-6 (Oct. 1998). For example, the current NPDES permit for the Greens Creek Mine reduced the mixing zone area by about forty percent, and the current NPDES permit for the Ballast Water Treatment Facility in Valdez reduced the mixing zone area by about twenty-three percent.

466. See EPA NPDES Permit No. AKG-285000 (Feb. 1999). For example, mixing zones at the Trading Bay and Granite Point oil production facilities in Cook Inlet nearly doubled in size between 1986 and 1996. The Trading Bay mixing zone, previously restricted to less than 0.5 miles is now nearly a mile in length in either direction from the outfall. Similarly, the Granite Point facility has had its mixing zone increased from less than 0.3 miles to 0.6 miles on either side of the discharge pipe. According to ADEC, these increases simply reflect the application of better algorithms for determining desired dilution volumes.

467. See Alaska Dep't of Env'tl. Conservation, *Public Notice Document No. 57352*, FAIRBANKS NEWS MINER, May. 21, 1997; Alaska Dep't of Env'tl. Conservation, *Public Notice Document No. 5775*, FAIRBANKS NEWS MINER, Aug. 1, 1997.

468. See Telephone Conversation with Pete McGee, *supra* note 359.

469. See ALASKA ADMIN. CODE tit. 18, § 70.240(a)(2) (2000).

470. See Letter from Kenwyn George, *supra* note 445, at 2.

WET testing, and it is assumed that the cumulative impact of these multiple mixing zones is sufficiently monitored by WET at the outer border of the cumulative mixing zone.⁴⁷¹ In other words, cumulative or multiple mixing zones are only monitored for chronic toxicity impacts to aquatic life.

The use of mixing zones in waters needed by anadromous and resident fish for spawning or rearing was, until recently, an active area of debate. Under the state's 1998 regulation, such a WQS modification was not prohibited because it relied on the demonstration of a potentially adverse impact. However the state recently approved a revision to the regulation that requires the following:

For streams, rivers, or other flowing fresh waters subject to (e)(3) of this section, a mixing zone will not be authorized in an area of (1) anadromous fish spawning; or (2) resident fish spawning redds for Arctic grayling, northern pike, rainbow trout, lake trout, brook trout, cutthroat trout, whitefish, sheefish, Arctic char (Dolly Varden), burbot, and landlocked coho, king, and sockeye salmon.⁴⁷²

Although this regulation would appear to once again prohibit mixing zones in anadromous waters, the state maintains that the policy will permit mixing zones in spawning areas if fish, eggs, or alevins are not physically present at the time of the discharge.⁴⁷³ The state has applied this temporal interpretation to the mixing zone rule under the placer miner general permit.⁴⁷⁴

As previously discussed, Alaska's mixing zone regulation permits mixing zones for virtually any substance in virtually any waterbody in the state. The regulation provides the state with broad discretionary power to circumvent all otherwise applicable WQS and the EPA's antidegradation policy.⁴⁷⁵ For a mixing zone application to be denied, "available evidence" must "reasonably demonstrate" that pollutants could concentrate in biota at "significantly adverse levels."⁴⁷⁶

471. *See id.*

472. ALASKA ADMIN. CODE tit. 18, § 70.255(h) (2000).

473. *See* Letter from Kenwyn George, *supra* note 445, at 2.

474. A stakeholder meeting convened to discuss this issue in 1998 deadlocked without reaching a decision. The creation of a smaller, more technically oriented group has been suggested to resume the discussions, but no meetings have as yet taken place.

475. *See* ALASKA ADMIN. CODE tit. 18, § 70.240(a). In order to approve mixing zones in public waters, "[i]n applying the water quality criteria and limits set by or under this chapter the department will, in its discretion, upon application, authorize a mixing zone in a discharge permit, certification, or order." *Id.*

476. *Id.* tit. 18, §§ 70.250(a), 70.250(a)(1)(A).

In summary, while the state's mixing zone policies have become increasingly precise over the past three decades they are arguably less restrictive than, and therefore do not support progress towards, the CWA's zero-discharge goal. The combination of the state's overall discretionary power with available evidence and demonstration tests insures that most if not every mixing zone application can be approved. The state engineer, who until recently was responsible for designing the state's mixing zones under the 401 Certification process, was aware of only one mixing zone application that the state had ever denied.⁴⁷⁷

V. MIXING ZONE ADJUDICATION

Efforts to reduce levels of water pollution since the passage of the CWA have focused primarily on development and application of the technology-based standards program, which has helped reduce the overall discharge of pollutants by an estimated one billion pounds per year.⁴⁷⁸ Because of this emphasis on the technology-based side of the NPDES permitting program, relatively little time and resources have been applied to the issue of mixing zones and Water Quality Based Effluent Limits (WQBEL).

It is not surprising then that a remarkably thin volume of federal case law exists regarding the use of mixing zones. A direct challenge to the fundamental concept that mixing zones weaken WQS, thereby allowing waters to exceed the criteria necessary to protect beneficial uses, has never been brought in federal court. Mixing zone litigation in the federal judicial record has focused on challenges brought by industry to the particulars of specific mixing zone authorizations.⁴⁷⁹ Nevertheless, several of these cases offer insights into courts' analysis of using dilution to meet federal pollution effluent limitations and state water quality standards. The following cases highlight the most significant decisions on mixing zones to date.

A. Ford Motor Co. v. EPA

The first important case to address the issue of meeting WQS through the dilution of effluent was *Ford Motor Co. v. EPA* in 1977.⁴⁸⁰ The suit focused primarily on the EPA's rejection of flow

477. See Letter from Kenwyn George, *supra* note 445.

478. See ROBERT W. ADLER ET AL., *THE CLEAN WATER ACT 20 YEARS LATER* 16 (1993).

479. See, e.g., *Hercules, Inc. v. EPA*, 598 F.2d 91 (D.C. Cir. 1978); *Ford Motor Co. v. EPA*, 567 F.2d 661 (6th Cir. 1977).

480. See *Ford*, 567 F.2d at 661.

augmentation (a dilution-based methodology) as a treatment method. However the case raised several very significant issues related to the general application of dilution as a means of meeting WQS in public waters.⁴⁸¹ The case involved pumping a large quantity of water from Lake Erie to a Ford plant for two distinct purposes.⁴⁸² A small percentage of the water was utilized as process water within the facility while the rest was employed as a diluent for the plant's heavy metal pollutants prior to their discharge into the Raisin River, which in turn flowed back into Lake Erie.⁴⁸³ The mixing zone issue in *Ford* related to the discharge of the plant's dilution canal water back into the Raisin River.⁴⁸⁴ The volume of the discharge was so great relative to the size of the river that the mixing zone spanned the width of the river for some distance downstream from the point of discharge.⁴⁸⁵

Michigan's water quality standards generally prohibited mixing zones from covering more than twenty-five percent of the stream width unless a finding of no potential harm was demonstrated to the satisfaction of the Michigan Water Resource Commission (MWRC).⁴⁸⁶ The EPA questioned the adequacy of Ford's mixing zone for protecting aquatic life, especially during low flow periods, and suggested that only fifty percent of the stream width be used.⁴⁸⁷ The MWRC responded by shortening the length of the mixing zone from approximately a mile to 900 feet, the site of the next intake pipe along the river.⁴⁸⁸ Although smaller in overall area, the mixing zone as proposed by MWRC still spanned the width of the river and therefore continued to preclude a pollution-free migration corridor.⁴⁸⁹ Nonetheless, the EPA approved the 900-foot long mixing zone proposed by MWRC despite its inconsistency with the recommendations found in EPA guidance documents of the time.⁴⁹⁰

According to the EPA, Best Practicable Control Technology (BPT) limitations imposed under the authority of section 301 of the CWA significantly reduced the levels of metals on the basis of total mass; however the effluent still exceeded Michigan's WQS for metals

481. *See id.* at 665.

482. *Id.*

483. *Id.*

484. *Id.*

485. *Id.*

486. *Id.*

487. *Id.*

488. *Id.* at 666.

489. *Id.*

490. *See id.*; *see also* NAT'L ACAD. OF SCI., *supra* note 216, at 112.

on the basis of receiving water concentrations.⁴⁹¹ In order to comply with Michigan's WQS, Ford proposed to use 137 million gallons per day of the water pumped from Lake Erie to dilute the effluent in a canal constructed on the site prior to its discharge into the Raisin River.⁴⁹² Such a treatment regime is known as flow augmentation.⁴⁹³ According to Michigan law, the total mass of pollutants was not controlled, only the concentration of pollutants in the receiving water.⁴⁹⁴ Ford intended to significantly increase the volume of the river and therefore raise the allowable level of pollutants discharged.⁴⁹⁵

The EPA communicated its concerns with Ford's proposal in a series of memoranda and letters to Ford and MWRC.⁴⁹⁶ In general, EPA representatives were unsure as to whether the use of flow augmentation was a legitimate means of meeting WQS under the CWA because "[a]s regards to national policy and the establishment of precedent, it would not appear that any policy guideline can be laid down either flatly prohibiting or approving flow augmentation to achieve a given water quality standard."⁴⁹⁷ The EPA eventually denied Ford the use of the flow augmentation scheme.⁴⁹⁸ According to the agency, the use of flow augmentation could not be permitted until it was demonstrated that all other potential mechanisms of treatment had been evaluated and rejected on either technical or economic grounds.⁴⁹⁹ Both Ford and the state of Michigan held their ground in requesting the use of flow augmentation.⁵⁰⁰ The lawsuit hinged on whether the EPA had the authority to prohibit the use of flow augmentation to dilute wastes in public waters.⁵⁰¹

The court cited a 1976 memorandum from the EPA Office of General Counsel that acknowledged, "[t]he [FWPCA] is silent on the question of whether this alternative is proper and legal as a method of meeting water quality standards based on concentrations."⁵⁰² The memorandum cited section 102 of the Act, which prohibits the storage

491. *Ford*, 567 F.2d at 665-66.

492. *Id.*

493. *Id.*

494. *Id.*

495. *Id.*

496. *Id.* at 667.

497. *Id.*

498. *Id.*

499. *Id.*

500. *Id.* at 667-68.

501. *See id.*

502. Memorandum from EPA Office of General Counsel to Regional Administrators and State NPDES Directors (Nov. 8, 1976) (on file with the *Tulane Environmental Law Journal*).

and release of waters “as a substitute for adequate treatment or other methods of controlling waste at the source.”⁵⁰³ In addition, the memorandum stated that the agency “clearly discourage[s] the use of flow augmentation [or dilution] as an alternative to treatment for meeting water quality standards.”⁵⁰⁴

Nevertheless, the court decided that section 102 did not prohibit the use of flow augmentation to meet water quality standards based on instream concentrations.⁵⁰⁵ Because there was no restriction against flow augmentation under Michigan regulation, its use could not be restricted by the EPA.⁵⁰⁶ According to the court, the EPA was required by Congress to adopt regulations and effluent guidelines controlling pollution in processes established in the record that included the opportunity for public comment.⁵⁰⁷ Therefore, the EPA’s decision to prohibit the use of flow augmentation, which was not clearly supported or prohibited in any guidelines or regulations was declared arbitrary, capricious, and an abuse of discretion.⁵⁰⁸ From this decision, one could presume that the use of mixing zones, which are conceptually similar to flow augmentation, would be similarly permissible because they too are not expressly forbidden by the Act. There was, however, a strong dissenting opinion criticizing the use of dilution and flow augmentation as a treatment protocol in this case, which will be discussed later.

B. Hercules, Inc. v. EPA

In 1978 two cases were consolidated and brought before the District of Columbia Circuit of the United States Court of Appeals challenging the EPA’s adoption of national effluent standards for the pesticides endrin and toxaphene.⁵⁰⁹ These regulations were the first national standards for toxic compounds adopted by the agency pursuant to the 1972 Amendments to the Act.⁵¹⁰ Final standards for

503. *Id.* (quoting Clean Water Act, 33 U.S.C. § 1252(b)(1)).

504. *Id.* at 1.

505. *Ford*, 567 F.2d at 671.

506. *Id.*

507. *Id.*

508. *Id.* The court held that “[a]d hoc national policy determinations developed through internal agency memoranda standing alone without promulgating regulations or guidelines through public notice and/or an opportunity for a public hearing, are not proper procedures for EPA to enforce the FWPCA.” *Id.* at 671-72.

509. *Hercules, Inc. v. EPA*, 598 F.2d 91, 97 (D.C. Cir. 1978).

510. *Id.*

the two pesticides were adopted in 1977 as required under the 1976 amendments to section 307 of the Act.⁵¹¹

In *Hercules, Inc. v. EPA*, the EPA failed to set effluent standards for toxaphene and endrin following its initial publication of draft standards in 1973.⁵¹² The EPA had calculated ambient water criteria for the pesticides based on laboratory studies of the effects of the pesticides on a variety of test organisms.⁵¹³ The court noted that “[t]he ambient water criterion is intended to be the maximum concentration of the toxic substance allowed in the nation’s waterways—a concentration low enough that even the most vulnerable important life in the water will be safe.”⁵¹⁴ In translating those ambient water criteria into effluent standards for the Velsicol and Hercules companies, the EPA assumed in both cases that the concentrated effluent would rapidly mix with receiving waters, and that few aquatic organisms would be exposed to the concentrated discharge.⁵¹⁵ The EPA adjusted the allowable concentrations of the pesticides in the effluents to reflect dilution factors of 300:1 for toxaphene and 375:1 for endrin.⁵¹⁶

The EPA’s application of dilution factors in this instance is distinct from state mixing zone policy, but does offer support for the basic principles of regulatory mixing zones. First, some degree of mixing was assumed to occur at every outfall.⁵¹⁷ Second, there was an assumption that the number of organisms harmed due to the existence of a mixing zone could be maintained at an “acceptable level” if the outfall was properly designed and sited.⁵¹⁸ In the agency’s opinion, employing a dilution factor of 375:1 for endrin and 300:1 for toxaphene was reasonable given the number of aquatic organisms that would have significant contact with the pesticides within the mixing zone.⁵¹⁹

It is important to emphasize that these dilution factors were applied to national effluent standards and were not related to the

511. *Id.* at 100 (citing 33 U.S.C. § 1317(a)).

512. *Id.* at 99.

513. *Id.*

514. *Id.* at 103.

515. The court addressed each pesticide separately because the two companies’ claims were based on slightly different grounds. For a discussion of toxaphene, see *id.* at 103. For a discussion of endrin, see *id.* at 115.

516. See EPA Toxic Effluent Standards, 42 Fed. Reg. 2,588, 2,594 (endrin) and 2,605-2,606 (toxaphene) (Jan. 1977).

517. *Hercules*, 598 F.2d at 103 n.23.

518. 42 Fed. Reg. 2,606.

519. *Hercules*, 598 F.2d at 103 n.23.

specific receiving waters at either site.⁵²⁰ By incorporating the 300-fold and 375-fold dilution factors into the national standards, the agency would have needed to assume that any potential discharger would have, at minimum, a sufficient volume of receiving water available to dilute the effluent.⁵²¹ Acknowledging that such an assumption may not reflect the hydrology and hydrography at other points of discharge, the EPA left open the opportunity for modification of the standard by other dilution factors that would be set on a site-specific basis.⁵²² The EPA recommended that in order to provide “ample margins of safety” as required under the Act, effluent concentrations could be appropriately reduced at individual sites.⁵²³

Challenges were filed immediately after the EPA published the effluent limits in its final adoption notice.⁵²⁴ The EPA’s dilution factors directly impacted the level of treatment required and therefore the costs of production. Velsicol and Hercules sought to significantly increase the size of these dilution factors to reflect the volumes and flows of their respective receiving waters.⁵²⁵ The court was asked to rule on the “reasonableness” of the EPA’s dilution factor calculation.⁵²⁶ In doing so, the court noted that the Act favors toxic substance abatement rather than dilution and that “[s]ection 101(a)(3) . . . expresses a ‘national policy that the discharge of toxic pollutants in toxic *amounts* be prohibited.’ Obviously, this national policy will be frustrated if the discharge of a toxic substance continues in the same amount, but merely in diluted form.”⁵²⁷ The legitimacy of dilution-based water treatment policy was questioned on the basis of the following comment cited from the CWA’s legislative history. During public debate on the CWA in 1972, then-EPA Administrator Ruckelshaus stated that “we don’t believe that the solution to pollution is dilution.”⁵²⁸ While the court acknowledged that the comment had been made in reference to the use of flow augmentation

520. See *id.* at 103-04 nn.23-24, 115 n.48.

521. See 42 Fed. Reg. 2,605-2,606.

522. *Id.* at 2,606.

523. Clean Water Act, 33 U.S.C. § 1317(a)(4) (1986). The effluent standards set by the agency were of two types: mass limitations and concentration limitations. Mass limitations were imposed to prevent concentration limits from being subverted because receiving water concentration limits could be achieved simply by diluting the waste stream with uncontaminated water prior to discharge. *Hercules*, 598 F.2d at 108.

524. *Hercules*, 598 F.2d at 108.

525. *Id.* at 116.

526. *Id.* at 107.

527. *Id.* at 108 (quoting 33 U.S.C. § 1251(a)(3) (1976)).

528. *Id.* (quoting Senate Comm. on Public Works, 93d Cong., A Legislative History of the Water Pollution Control Act Amendments at 1228 (1973)).

and not the setting of toxics standards, it accepted the statement as “express[ing] a general view not limited to that matter.”⁵²⁹ The court also noted that the very notion of mixing zones was “controversial.”⁵³⁰ However, the court accepted the EPA’s general support for the “mixing zone concept,”⁵³¹ which the agency substantiated in the record by citing technical documents such as the 1972 Blue Book.⁵³² Furthermore, the court accepted that mixing zones were applicable by the EPA under section 307 via a process less thorough than the “elaborate water quality calculation methods” used to determine WQS.⁵³³ Citing Congress’s intent to leave the setting of site-specific WQS to the states, the court decided that the EPA’s dilution factor determination had in fact been a reasonable compromise.⁵³⁴

C. Marathon Oil Co. v. EPA

Marathon Oil Co. v. EPA highlighted several key aspects of mixing zone application and the relationship between the EPA and states without delegated NPDES authority.⁵³⁵ Marathon Oil had two outfall pipes discharging toward Cook Inlet, Alaska.⁵³⁶ The word “toward” was critical to the underlying premise of the case because one of the pipes discharged above the high water mark, and the other was submerged for only approximately half of the tidal cycle.⁵³⁷ In 1985, the EPA released a draft NPDES permit renewal banning all discharges above the five-meter (16.4 feet) isobath measured at the mean low water mark.⁵³⁸ Under the proposed permit, the facilities were required to extend their outfall pipes a significant distance into Cook Inlet to insure that their discharges were submerged at all times.⁵³⁹ The EPA had expressed concerns to the state that Marathon’s open outfalls might violate Alaska’s WQS, specifically, the state regulation prohibiting the creation of “a significant potential for adverse environmental or health effects.”⁵⁴⁰ Marathon asserted that during previous permit cycles no showing of harm to the environment

529. *Id.* at 108 n.30.

530. *Id.* at 116.

531. *Id.* at 116 n.50.

532. *Id.* (citing NAT’L ACAD. OF SCI., *supra* note 216).

533. *Id.* at 116.

534. *Id.* (citing 33 U.S.C. § 1313 (1976)).

535. *See* *Marathon Oil Co. v. EPA*, 830 F.2d 1346 (5th Cir. 1987).

536. *Id.* at 1346-47.

537. *See id.*

538. *Id.* at 1349.

539. *Id.*

540. *Id.* at 1351 (citing ALASKA ADMIN. CODE tit. 18, § 70.032 (1987)).

had been demonstrated and that, given “reasonable mixing zones,” the existing discharges were consistent with the state’s WQS in their present configuration.⁵⁴¹ However, the court declined to rule on whether the EPA needed to show harm to the environment under Alaska state standards in order to ban open discharge.⁵⁴²

A major source of confusion prior to the case resulted from ADEC’s mistaken impression that it was constrained by federal law to arrive at a mixing zone determination agreeable to the EPA.⁵⁴³ The EPA’s role with respect to the inclusion of mixing zones in NPDES permits in nondelegated states is confined to assuring that WQBEL based on state WQS are correctly applied to support appropriate technology-based guidelines.⁵⁴⁴ Once the EPA has approved a state regulation as consistent with the CWA, any correct application of the regulation is assumed to be consistent with the CWA as well.⁵⁴⁵ The EPA attempted to make it clear to state officials that a consistency determination between the permit and Alaska’s water quality standards regulations was a matter of state discretion, and that Alaska would have the final say on interpreting Alaska law.⁵⁴⁶

The EPA’s draft permit stipulated that Marathon’s discharge be moved to the five-meter isobath to permanently submerge the outfalls.⁵⁴⁷ The EPA recognized that if ADEC assigned a “typical” mixing zone of 100 meters (328 feet) the discharges would probably result in violations of Alaska’s WQS. However, the EPA was aware that ADEC was considering mixing zones proposed by the companies as large as several kilometers.⁵⁴⁸ Nonetheless, the EPA appeared satisfied by the draft permit because the proposed changes over past permits represented a “significant improvement over the current situation.”⁵⁴⁹

The root of the disagreement between the company and the agencies can be traced to two assumptions regarding the dimensions and location of the company’s proposed mixing zones. First, Marathon based its mixing zone request on a time-averaged calculation of the dilution potential at the site through one complete

541. *Id.* at 1347.

542. *Id.* at 1347-48 n.8. On the other hand, whether current discharges violated state water quality standards was very much at issue. *See id.* at 1348.

543. *Id.* at 1351 n.26.

544. *See* Memorandum from Robert Perciasepe, *supra* note 284, at 3.

545. *See id.*

546. *Marathon*, 830 F.2d at 1351.

547. *Id.* at 1349.

548. *Id.*

549. *Id.* (citing Record at 17222, *Marathon Oil*, 830 F.2d at 1346).

tidal cycle.⁵⁵⁰ According to the company, this was a reasonable assumption given the low potential for dilution at high and low tides, and the high dilution potential between those times.⁵⁵¹ The variation in dilution ranged over several orders of magnitude depending upon the time of day.⁵⁵² Second, Marathon's consultants estimated the proficiency of the mixing zone as if the discharges were constantly submerged in one meter of water.⁵⁵³ As stated earlier, not only were the outfalls not constantly submerged, in one case, the outfall pipe was not submerged at all.⁵⁵⁴ The legal challenge revolved on the fact that the mixing zones in the EPA's permit were based on a worst-case scenario of dilution at a constantly submerged outfall, rather than the time-averaged dilution factor at a partially submerged or exposed outfall.⁵⁵⁵

The court offered several comments on the general nature of mixing zones. First, the court accepted that the use of mixing zones was unavoidable, given the technology of the day and society's need to continue to discharge wastes.⁵⁵⁶ Briefly explaining the notion of a mixing zone, the court stated that a "'mixing zone' is simply the area of dispersal in the receiving waters where the pollutants in the effluent are not sufficiently diluted to meet water quality standards."⁵⁵⁷ Second, the court envisioned the assignment of a mixing zone to essentially depend upon economic and social considerations such as "a cost-benefit judgement on a given set of environmental facts, rather than any sort of 'scientific' determination."⁵⁵⁸ Third, the court recognized that the size of a mixing zone could be set totally independent from what is needed to dilute the effluent from a general-purpose formula or a "rule of thumb" approach.⁵⁵⁹ In other words, mixing zones were specifically definable in physical and chemical terms, yet at the same time derivable on the basis of general policy or economic need. Agency arguments for the extension and submergence of the outfalls was upheld, and ADEC certified mixing zones of 750 meters (0.47 miles) in either direction from the outfall at

550. *Id.* at 1350.

551. *Id.*

552. *Id.* The dilutions ranged from 16:1 to 20,000:1. *Id.*

553. *Id.*

554. *See id.* at 1346-47.

555. *See id.* at 1353-54.

556. *Id.* at 1349.

557. *Id.*

558. *Id.* at 1351.

559. *Id.* at 1349.

Trading Bay facility and 450 meters (0.28 miles) in either direction from the outfall for the facility at Granite Point.⁵⁶⁰

D. Ackels v. EPA

In *Ackels v. EPA*, placer miners in Alaska raised a procedural issue concerning the application of the state's mixing zone regulation.⁵⁶¹ The case was brought after a previous decision, *Trustees v. EPA*, forced the EPA to reissue a NPDES permit for placer mining with an effluent limit for turbidity and to hold public hearings before imposing effluent limitations on arsenic and mercury.⁵⁶² The miners challenged the permit because the EPA had not included a mixing zone for arsenic, even though the Alaska WQS in force at the time the permit was reissued prohibited mixing zones for toxic pollutants that could cause cancer.⁵⁶³ Therefore the court upheld the EPA's action because the agency had correctly applied the state's mixing zone regulation.⁵⁶⁴

E. Puerto Rico Sun Oil Co. v. EPA

In 1993, the Puerto Rico Sun Oil Company sued the EPA to challenge effluent limitations included in a renewal of its NPDES discharge permit.⁵⁶⁵ The main issue of the challenge was procedural in nature.⁵⁶⁶ The EPA had not incorporated a mixing zone dilution factor into the permit effluent limits after the Puerto Rico Environmental Quality Board failed to amend a mixing zone request in a timely fashion.⁵⁶⁷ The court found the EPA's actions arbitrary and capricious and remanded the permit to the EPA for revision.⁵⁶⁸

Additionally, several points germane to the generic issuance of mixing zones were raised. First, in describing the principles and practices behind the use of mixing zones, the court cited from the record in *Marathon v. EPA*, affirming that a mixing zone is "basically

560. *Id.* at 1353-54.

561. *Ackels v. EPA*, 7 F.3d 862, 865 (9th Cir. 1993).

562. *Trustees for Alaska v. EPA*, 749 F.2d 549, 561 (9th Cir. 1984).

563. *See* ALASKA ADMIN. CODE tit. 18, § 70.032 (July 1985). A similar provision in the current code appears at section 70.250 (a)(1)(B). Arsenic is a known carcinogen.

564. *Ackles*, 7 F.3d at 866. As previously noted, the CWA requires the application of effluent limits that will result in achieving the water quality standards. *See* Clean Water Act, 33 U.S.C. § 1313(b)(1)(C) (1994).

565. *Puerto Rico Sun Oil Co. v. EPA*, 8 F.3d 73, 76 (1st Cir. 1993).

566. *See id.*

567. *Id.* at 75-76.

568. *Id.* at 81.

a cost-benefit judgement.”⁵⁶⁹ Second, the company and the EPA agreed that without the application of a mixing zone, the oil refinery would be incapable of meeting water quality standards and unable to operate with its current wastewater treatment systems.⁵⁷⁰ Third, the court noted that the CWA could require pollution concentrations to be measured at the point of discharge. The court also noted that the use of dilution was not expressly forbidden, by stating that “alternatively, it could be measured at the *edge* of a defined area of the receiving body of water after the pollutant has been diluted by that water.”⁵⁷¹ Fourth, the court recognized the “widespread” acceptance of mixing zone application, although it did not reference a specific passage of the CWA that would support such an interpretation of the law.⁵⁷²

In its conclusion, the court noted that it did not mean to “suggest that mixing zone analysis has a sacrosanct role under the Clean Water Act.”⁵⁷³ Its “impression” of widespread mixing zone use was “subject to correction,” and “sound reasons may dictate that a mixing zone analysis not be used in certain cases or certain classes of cases,” perhaps even in this specific case.⁵⁷⁴

F. American Iron and Steel Institute v. EPA

In 1997, *American Iron and Steel Institute v. EPA* addressed the use of mixing zones for persistent, bioaccumulative substances.⁵⁷⁵ Although focused on a particular subset of chemicals, this case marks the strongest effort to date by the EPA to restrict the use of mixing zones for any substances in United States’ waters.⁵⁷⁶

The United States and Canada adopted the *Great Lakes Water Quality Agreement of 1978*,⁵⁷⁷ and the *Water Quality Agreement of 1987*,⁵⁷⁸ to enable the two countries to jointly address the deteriorating condition of the Great Lakes. In 1987, Congress established the Great Lakes National Program Office along with a general outline of research activities and demonstration projects to incorporate the goals

569. *Id.* at 75.

570. *Id.* at 76.

571. *Id.* at 75 (emphasis added).

572. *Id.*

573. *Id.* at 81.

574. *Id.*

575. *See* *Am. Iron and Steel Inst. v. EPA*, 115 F.3d 979 (D.C. Cir. 1997).

576. *See id.*

577. *See* Great Lakes Water Quality Agreement, Nov. 22, 1978, U.S.-Can., 30 U.S.T. 1383.

578. *See* Protocol Between the United States of America and Canada, Nov. 18, 1987, U.S.-Can., T.I.A.S. No. 11551.

of the Great Lakes agreements into the CWA.⁵⁷⁹ The purpose of this effort was to ascertain the status of and reduce the concentrations of pollutants in the water column and sediments of the Great Lakes with particular attention to toxic chemicals.⁵⁸⁰

In 1995, the EPA promulgated the *Final Water Quality Guidance for the Great Lakes System*, also known as the Great Lakes Guidance (GLG).⁵⁸¹ The American Iron and Steel Institute (AISI) challenged three points in the GLG mixing zone section to the United States Court of Appeals for the D.C. Circuit in *American Iron and Steel Institute v. EPA*.⁵⁸² AISI challenged Procedure 3.C of the GLG, which established that after March 23, 1997, new discharges should no longer be provided with mixing zones for “bioaccumulative chemicals of concern” (BCCs).⁵⁸³ Furthermore, all mixing zones for BCCs should be eliminated from all discharge permits authorized for waters draining into the Great Lakes by March 23, 2007.⁵⁸⁴ AISI also challenged Procedure 3.D, which would restrict mixing zones to the areas of discharge-induced mixing (i.e., areas of dilution based primarily on the turbulence created by the momentum of the discharge).⁵⁸⁵ Finally, AISI challenged Procedure 3.E, which recommended that mixing zones embrace no more than twenty-five percent of the design flow of the receiving water.⁵⁸⁶

Insofar as it challenged Procedures 3.D and 3.E, AISI’s petition was denied.⁵⁸⁷ The court determined that the EPA had acted within its authority and with due diligence to reach rational, defensible positions.⁵⁸⁸ The court did however find in favor of AISI on Procedure 3.C.⁵⁸⁹ The court remanded Procedure 3.C, the ban on new mixing zones for BCCs and the phase-out of existing BCC mixing zones, to the agency.⁵⁹⁰ The court found the agency’s analysis of the cost justification relative to the level of environmental benefit to be inadequate.⁵⁹¹ The EPA’s response to the court’s action can be

579. See Clean Water Act, 33 U.S.C. § 1268(b)-(c) (1986).

580. See *id.* § 1268.

581. See Final Water Quality Guidance for the Great Lakes System, 60 Fed. Reg. 15,366-15,425 (Mar. 23, 1995) (portions codified at 40 C.F.R. §§ 9, 121-122, 131-132).

582. *Am. Iron and Steel Inst. v. EPA*, 115 F.3d 979, 996 (D.C. Cir. 1997).

583. *Id.*

584. *Id.*

585. *Id.*

586. *Id.*

587. *Id.* at 998.

588. *Id.*

589. *Id.* at 997.

590. *Id.*

591. *Id.*

ascertained from a memorandum released by the agency within two months of the decision.⁵⁹² According to the memorandum from EPA Deputy Director Jim Hanlon, the court failed to grasp the EPA's cost-benefit analysis, which addressed the issue of marginal benefits at high cost by the use of specific exemptions.⁵⁹³ Hanlon noted that the EPA would attempt to reinstate Procedure 3.C.⁵⁹⁴

G. *Red Dog Mine Mixing Zone Proposal*

The Red Dog Mine, located near Kotzebue in Northwest Alaska, is one of the largest lead-zinc mines in North America.⁵⁹⁵ Mineralized deposits in the region are located on or very close to the surface.⁵⁹⁶ Soon after startup, water running through the exposed ore body caused increased metals concentrations in Middle Fork Red Dog Creek.⁵⁹⁷ Water quality was degraded in Red Dog Creek and Ikalukrok Creek by low pH and elevated levels of cadmium, lead, and zinc.⁵⁹⁸

The mine operator, Cominco Alaska Inc., added lime to precipitate the metals from the wastewater stream, and collected the seepage water from the ore body and pumped it back into the tailings pond to be held for treatment. This treatment regime removed a higher percentage of the metals but increased the level of total dissolved solids (calcium sulfate) in the effluent.⁵⁹⁹ Over a period of several years in the mid-1990s the operator requested regulatory relief from the State and the EPA to address the increased TDS levels, in the form of site-specific considerations, water use reclassifications, and a mixing zone.

At the request of Cominco, the Alaska Department of Environmental Conservation issued a draft Certificate of Reasonable Assurance that included a 6.5 mile-long mixing zone for total

592. See Memorandum from Jim Hanlon, EPA Deputy Directory of the Office of Science and Technology, to Kathleen C. Callahan, Director, Environmental Protection and Planning, EPA Region II, et al. (July 31, 1997) (on file with the *Tulane Environmental Law Journal*).

593. See *id.* at 4.

594. See *id.*

595. See Telephone Conversation with Phyllis Weber-Scannell, Ph.D., Habitat Biologist IV, Alaska Dep't of Fish & Game (2000) (on file with author); ALASKA DEP'T OF FISH & GAME, DIV. OF HABITAT AND RESTORATION, TECH. REPORT NO. 00-3 (on file with author).

596. See *id.*

597. See *id.*

598. See *id.*

599. See Telephone Conversation with Phyllis Weber-Scannell, Ph.D., Habitat Biologist IV, Alaska Dep't of Fish & Game (Jan. 18, 2001) (on file with author).

dissolved solids.⁶⁰⁰ The Certificate was denounced by a statewide water quality advocacy organization, alleging that the certification violated numerous sections of the state's mixing zone regulation, including rules governing allowable toxicity to aquatic life, permissible levels of total dissolved solids and sulfate, size limitations, and requirements for human health risk assessments.⁶⁰¹

Less than one week after the hearing request was filed the state withdrew the permit certification and offered to settle the dispute.⁶⁰² A settlement was reached to allow the mine to continue to operate, requiring process changes by the mine operators, and a concurrent administrative review of several key WQS.⁶⁰³ The facility continues

600. See Cominco Red Dog Mine, State of Alaska, Department of Environmental Conservation, Certificate of Reasonable Assurance, NPDES AL-003865-2 (June 15, 1995).

601. See Letter from Eric P. Jorgensen et al., Sierra Club Legal Defense Fund, to ADEC (July 20, 1995) (requesting adjudicatory hearing on Certificate of Reasonable Assurance for proposed NPDES Permit No. AK-0038625-2 for the Red Dog Mine) (on file with the *Tulane Environmental Law Journal*). The following excerpt from the hearing request identifies the numerous mixing zone sections believed to be violated in the permit certification:

As a result of these failures, the certification does not . . . ensure compliance with the following requirements of the mixing zone regulation:

- (a) "A mixing zone must be as small as practicable . . ." 18 AAC 70.032(d).
- (b) The Department may not permit a mixing zone "if there could be an adverse impact on anadromous or resident fish or shellfish spawning or rearing, [or] a barrier formed to migratory species . . ." 18 AAC 70.032(a)(2).
- (c) The Department may not permit a mixing zone if "there could be an environmental effect so adverse that a mixing zone is not appropriate." 18 AAC 70.032(a)(4).
- (d) "In determining whether a mixing zone is appropriate, and in determining the size of a mixing zone, the department will ensure that existing uses of the waterbody as a whole are maintained and fully protected so that any discharge will neither partially nor completely eliminate an existing use in a waterbody as a whole, . . . or impair the overall biological integrity of the waterbody." 18 AAC 70.032(c).
- (e) In determining the appropriateness and size of a mixing zone, the Department must consider "the effects that the discharge might have on the uses of the receiving water; . . . and . . . the cumulative effects of multiple mixing zones . . ." 18 AAC 70.032(c)(2) & (7).
- (f) "The department will reduce in size or deny a mixing zone if the department finds that available evidence reasonably demonstrates that pollutants discharged will . . . preclude or eliminate established processing activities or commercial, sport, personal-use, or subsistence fish and shellfish harvesting." 18 AAC 70.032(e).
- (g) "[A] mixing zone may not extend downstream beyond the point of complete mixing" unless the applicant demonstrates that "the size limitations can be safely increased . . ." 18 AAC 70.032(f)(3)(A).
- (h) "[A] mixing zone may not result in (i) permanent or irreparable displacement of indigenous organisms or (ii) a reduction in fish population levels in the waterbody . . ." 18 AAC 70.032 (f)(3)(C).

Id. at 2-3.

602. See Adjudication of NPDES Permit No. AK-003865-2, Cominco Alaska, Inc. (Red Dog Mine), No. 225-96-0010, Stipulation to Dismiss Adjudication (ADEC, Sept. 25, 1996).

603. See *id.*

to operate under an extended NPDES permit that does not authorize any mixing zone dilution allowance.⁶⁰⁴

Nearly three decades of mixing zone use have resulted in remarkably few challenges in federal court. Litigation has focused on the physical parameters of mixing zones, the application or misapplication of modeling protocols, and relatively simple questions of procedure and authority. Nevertheless, a number of general principles regarding mixing zone application can be gleaned from examining the court record. First, courts will obviously defer to public agencies on technical matters that the agencies have been empowered to address by Congress.⁶⁰⁵ A corollary to this rule is that the courts generally restrict themselves to deciding if the agencies have acted in a reasonable manner.⁶⁰⁶ The court's actions in mixing zone cases are certainly consistent with these rules.

In *Hercules* the court supported mixing zone parameters developed by agency staff against challenges by the dischargers.⁶⁰⁷ The court maintained that significant deference was owed to the EPA to make reasonable decisions regarding mixing zones, and to determine "the choice of a precise figure" for their application.⁶⁰⁸ Furthermore, the court stated that the burden of proof necessary to alter decisions such as mixing zone determinations rested with the applicant.⁶⁰⁹

The court in *Marathon* reinforced the right of the agencies to determine the correct methodology for mixing zone determinations, and adopt conservative approaches where warranted.⁶¹⁰ The court found that state and federal regulators were justified in prohibiting potentially harmful discharge of wastes within intertidal areas and rejecting the use of the intertidal area as part of the mixing zone because Alaska's Administrative Code defined the use that protects aquatic life to include "adjoining shorelines."⁶¹¹

The more recent decision in *AISI v. EPA* supported EPA guidance regarding mixing zones in the Great Lakes Region, demonstrating that the *Chevron* rule regarding agency deference on technical issues still

604. *See id.*

605. *See Hercules, Inc. v. EPA*, 598 F.2d 91, 115 (D.C. Cir. 1978).

606. *See id.*

607. *Id.* at 116.

608. *Id.* at 117.

609. *Id.* at 107.

610. *See Marathon Oil Co. v. EPA*, 830 F.2d 1346, 1355-56 (5th Cir. 1987).

611. *Id.* at 1347 n.5.

holds.⁶¹² The court supported the EPA's recommendation that mixing zone size be limited to twenty-five percent of the lake design flow (roughly equal to the cross-sectional area of the lake).⁶¹³ The court also upheld the EPA's recommended discharge-induced default boundary to the volume necessary to produce a 10:1 dilution.⁶¹⁴

It is worth noting that despite the questions over mixing zone application raised by *AISI v. EPA*, the EPA still supports the notion that rules developed by individual states to govern mixing zone application should remain largely under state control.⁶¹⁵ However, section 118 of the CWA requires the EPA to provide guidance to the Great Lakes States on minimum WQS, antidegradation policies, and implementation procedures for the Great Lakes System.⁶¹⁶ The CWA further requires the Great Lakes States to adopt minimum WQS, antidegradation policies, and implementation procedures consistent with the EPA's guidance within two years after the agency publishes final guidance.⁶¹⁷ The EPA has used this authority to exert significant control over the application of mixing zones, which it considers implementation procedures, in the Great Lakes States, specifically with regards to the use of dilution factors for discharges containing bioaccumulative chemicals.

A second common theme that can be drawn from examining the court record supports the EPA/state regulatory relationship briefly noted above with regard to mixing zones. In essence, states enjoy significant discretion to interpret and apply their regulations after the EPA determines that the rules are consistent with the CWA.⁶¹⁸

A third conclusion drawn by several courts is that mixing zones are cost-benefit judgments on a given set of environmental facts.⁶¹⁹

612. *Am. Iron & Steel Inst. v. EPA*, 115 F.3d 979, 996-98 (D.C. Cir. 1997).

613. *Id.* at 997-98.

614. *Id.* at 998.

615. See Memorandum from Robert Perciasepe, *supra* note 284.

616. See Clean Water Act, 33 U.S.C. § 118(e)(2)(B) (1994).

617. See 33 U.S.C. § 118(e)(2)(C).

618. The EPA recommendation of mixing zone boundaries to the Michigan Water Resources Commission to provide an unpolluted fish migration corridor was rejected by the state agency. *Ford Motor Co. v. EPA*, 567 F.2d 661 (6th Cir. 1977). The EPA had been concerned that oil producing facilities in Alaska were unlikely to meet Alaska's WQS with the provision of "typical" 100 meter mixing zones. *Marathon Oil Co. v. EPA*, 830 F.2d 1346 (5th Cir. 1987). The state responded by incorporating mixing zones of approximately 1 kilometer and 1.5 kilometers into the NPDES permits. In *Puerto Rico Sun Oil Co. v. EPA*, the court remanded a permit to the agency for inclusion of a mixing zone, despite finding EPA actions in finalizing the permit without a mixing zone to be legally correct. It was clear to the court that the territorial agency had wished to include a mixing zone into the permit. The EPA's actions, although legal, were found to be arbitrary and capricious. *Puerto Rico Sun Oil Co. v. EPA*, 8 F.3d 73 (1st Cir. 1993).

619. See *Puerto Rico*, 8 F.3d at 75; *Marathon Oil*, 830 F.2d at 1349.

As a result we are confronted again by the effluent limits versus WQS paradox, despite previous discussion demonstrating that mixing zone policies are effluent limitation mechanisms.⁶²⁰ As noted previously, effluent limitations may be permitted by the CWA to incorporate economic feasibility for classes of dischargers, but the purpose of mixing zone policies is to modify the WQS in specific discharge permits on the basis of a set of scientific facts.⁶²¹ It is therefore unclear whether mixing zones may legally modify WQS on the basis of economics. In the case of Alaska's WQS, at issue in *Marathon*, there was at the time no provision for including economic considerations into the development of mixing zones. More recent regulatory adoptions in Alaska have allowed for the inclusion of cost factors into specific mixing zone determinations. However, it is unclear whether such a practice is legitimate under the Act.

Additionally, although courts supported the application of specific mixing zones, this support was not offered without reservations regarding the overall legality of mixing zones under the Act. The court in *Puerto Rico Sun Oil Co.* affirmed that the law does not in any way sanction the use of mixing zones because "nothing in that statute explicitly requires the EPA to use mixing zone analyses in its permits."⁶²² The case that most closely examined the use of dilution to achieve WQS was *Ford*, in which the employment of flow augmentation, a dilution-based treatment mechanism, was debated.⁶²³ The court majority supported the application of flow augmentation since it was not being employed as a substitute for other methods of treatment, and because its use was not expressly forbidden in any published regulation, guideline or specific statutory provision.⁶²⁴ While mixing zones were not discussed per se in that context, the majority decision would most likely have applied to mixing zones as well, since they are similarly not restricted by the Act nor by other federal regulations and guidelines.

The question of abatement versus dilution was also addressed in *Hercules*, where the court supported the EPA's adoption of mass limitations in addition to concentration limitations to insure that the overall level of pollutant loading was kept in check.⁶²⁵ The court

620. See *Wis. Elec. Power Co. v. Wis. Natural Res. Bd.*, 280 N.W. 2d 218, 226 (Wis. 1979).

621. See Clean Water Act, 33 U.S.C. § 1311(b)(2)(A) (1994); *Am. Iron & Steel Inst. v. EPA*, 115 F.3d 979, 998 (D.C. Cir. 1997).

622. *Puerto Rico*, 8 F.3d at 77.

623. See *Ford Motor Co.*, 567 F.2d at 666.

624. *Id.* at 671-72.

625. *Hercules, Inc. v. EPA*, 598 F.2d 91, 109-10 (D.C. Cir. 1978).

noted that the fundamental issue of mixing zones was controversial and that according to a leading commentator, the 1972 CWA “probably does not allow mixing zones at all.”⁶²⁶

Finally, an Alaska 401 Certification challenge was reviewed in which a mixing zone proposed by the state regulatory agency was eventually removed from a NPDES permit on the merits of a public challenge.⁶²⁷ It is worth noting that despite the successful effort to block the incorporation of the mixing zone into the State certification, the applicant eventually achieved nearly all regulatory relief originally sought. Shortly after the mixing zone was removed from the certification, the mining company successfully petitioned the state to downgrade the classification of the waterbody receiving the discharge. In addition, statewide WQS for which the mixing zone had been sought were weakened, obviating the need for the mixing zone.

VI. CONCLUSION

This Article sheds light on the definition, origin, and evolution of mixing zone use over the past three and a half decades since federal law first required states to adopt ambient water quality standards. Mixing zones are pollution dilution zones in public waters, which is a modern interpretation of the age-old notion that pollution problems can be addressed through assimilative capacity.⁶²⁸ The dilution/assimilation paradigm has consistently played the lead role in water pollution management. Today, dilution and assimilation is authorized throughout the United States by the assignment of mixing zones in federal discharge permits.⁶²⁹ Further, mixing zones are water quality management policies with an identity crisis. They walk a possibly nonexistent line between their legal construction as effluent limitations, intended to facilitate the achievement of WQS or federal criteria, and their actual purpose, which is to accommodate dischargers that cannot or choose not to install treatment mechanisms necessary to meet the WQS or federal criteria. In addition, mixing zone regulations are drafted by the federal, state, tribal, and territorial governments, and courts proffer a significant degree of latitude to those entities for their administration. The federal government’s role in mixing zone authorization by states, tribes, and territories is primarily that of an “interested observer.”⁶³⁰ Also, pollutant

626. *Id.* at 116 (quoting Hall, *supra* note 74, at 628 & n.109).

627. *See* Adjudication of NPDES Permit No. AK-003865-2, *supra* note 602.

628. *See* PERRY & VANDERKLEIN, *supra* note 3, at 30-31.

629. *See id.*

630. *Marathon Oil Co. v. EPA*, 830 F.2d 1346, 1351 (5th Cir. 1987).

concentrations within mixing zones regularly exceed scientifically derived chronic and acute aquatic life criteria and human health criteria. Mixing zones are permitted to preclude the enjoyment of existing uses within the dilution area, as long as the authorizing federal, state, tribal, or territorial agency demonstrates to its own satisfaction that the integrity of the waterbody as a whole is being protected.⁶³¹ Finally, mixing zones may be applied to permits in nearly every waterbody in the United States for virtually any pollutant.⁶³²

Despite the routine application of mixing zones today, key questions surrounding their identity and legality have remarkably continued to avoid serious scrutiny. Although mixing zones are defined in numerous federal guidance documents, the interpretation of those definitions by managers with varying needs and areas of expertise has perpetuated confusion as to the legitimate role, identity, and scope of mixing zone application. Engineers and chemists consider mixing zones as mathematical problems related to the diffusion characteristics of dissimilar liquids.⁶³³ Biologists view mixing zones in more holistic terms related to their effects on sustaining organisms and habitat.⁶³⁴ To some courts, mixing zones have been viewed as social and economic judgments based on a comparison of costs to benefits.⁶³⁵ These definitions reflect fundamentally distinct perspectives that may never be unified, because governments tend to act expediently, and a unification of these definitions is not essential for the continued application of mixing zones. Given the range of definitions recognized by water quality managers, the regulated community, and the courts, it is not surprising that mixing zone authorization has remained a highly subjective exercise.

Perhaps more important than the legal definition of mixing zones is the discretionary power regulators possess for their application. Mixing zones are treated as routine variances; administrative mechanisms by which dischargers request and receive weakened pollution limits in discharge permits. There is not, however, any language in the CWA supporting the application of mixing zones as variances.⁶³⁶ Single-sentence federal regulations have institutionalized this arguably pre-

631. See EPA, TECHNOLOGICAL SUPPORT DOCUMENT, *supra* note 52.

632. See generally EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1.

633. See *id.* at 5-6 to 5-7.

634. See *id.* at 5-1 to 5-2.

635. See, e.g., *Marathon Oil Co. v. EPA*, 115 F.3d 979, 997 (D.C. Cir. 1997).

636. See generally Clean Water Act, 33 U.S.C. §§ 1251-1376 (1994).

CWA philosophy of pollution management based on assimilative capacity for use by the EPA and state, tribal, and territorial agencies.

Despite the layers of legal support for mixing zones established in federal and state regulations, when viewed directly against the context and purposes of the CWA, the application of mixing zones appears extremely problematic. Taken at face value, the Act's goals, objectives, and prohibitions seem to prohibit the authorization of mixing zones as currently implemented.⁶³⁷ Mixing zones, especially for pollutants that persist in the environment or bioaccumulate, do not maintain or improve the quality of the public's waters; they provide a legal mechanism for its degradation.⁶³⁸ Mixing zones do not lead to the elimination of polluted discharges into public waters; they sanction the discharge of pollutants at levels that exceed otherwise applicable water quality standards and federal criteria.⁶³⁹ In so doing, mixing zones preclude the use of portions of public waters for drinking, fish harvesting, recreation, aesthetic and cultural needs, and other less damaging economic purposes. Mixing zones do not comply with the CWA's prohibition against creating toxic conditions; they expressly allow the discharge of toxic substances in toxic amounts.⁶⁴⁰ In sum, mixing zones appear fundamentally incongruous with the principles by which Congress intended to reform the nation's management of water pollution.⁶⁴¹

The Act was drafted and amended with the understanding that the country was not yet ready for the imposition of a zero-discharge law.⁶⁴² However, accepting the inevitability of some mixing of wastestreams and receiving waters did not have to necessarily lead to a policy that circumvents other principles of the CWA. The problem with mixing zones vis-à-vis the Act is not that they permit a lowering of water quality; it is the degree to which they permit waters to be polluted. To understand this relationship, we need to answer two questions: (1) on what basis were the mixing zone policies we now implement constructed, and (2) to what extent does the CWA permit mixing to occur?

The first question is relatively simple to answer. Current mixing zone practices developed in response to circumstance. Prior to 1972,

637. *See id.* § 1251(a).

638. *See id.*

639. *See id.* § 1251(a)(1).

640. *See id.* § 1251(a)(3).

641. *See id.* § 1251(a).

642. Note the conflict between the goal of a discharge ban at 33 U.S.C. § 1251(a)(1) and the technology standards of 33 U.S.C. § 1311(b).

pollution dilution was not prohibited, provided there was no demonstration of downstream harm. With the passage of the CWA, a young EPA found itself faced with a major dilemma: the oversight of tens of thousands of discharging facilities built under the pre-1972 FWPCA. Many of these discharges would soon become illegal, unless the EPA could authorize them in permits that complied with new, more stringent national standards. The EPA's formidable task was to insure that existing and future discharges would meet the goals and directives of the CWA without a major disruption in the country's industrial economy. The more immediate crisis was solved directly by the law. The CWA provided allowances for existing sources to continue to discharge pollutants while advances were made in waste treatment technology and new rules were developed and adopted.⁶⁴³ The present situation was under control, but how was the EPA to address future discharges under a law that called for the eventual elimination of all releases of wastes into public waters? The EPA solved this dilemma by continuing to apply the principle of assimilative capacity. According to the EPA, Congress did not intend the CWA's goals, objectives, and prohibitions to apply to the whole waterbody; rather, the protections were to apply to the "waterbody-as-a-whole."⁶⁴⁴ This principle is fundamental to the EPA's overall interpretation of the CWA, and is the crucial rationalization underlying the EPA's acceptance of all mixing zone policies.

Answering the second question, regarding the permissible level of impacts from mixing, is a far greater challenge. The task may be facilitated by another brief review of the CWA's history. To a great degree, the 1972 amendments of the FWPCA were a direct response to the failure of state-based ambient water quality programs to adequately protect the nation's waters.⁶⁴⁵ In addressing the lackluster performance of state-enforced water quality management, and specifically the record of the states in bringing polluters to task for violations of the states' own standards, the Senate Public Works Committee reported:

The record shows an almost total lack of enforcement. Under this procedure, only one case has reached the courts in more than two decades. . . .

. . . .

643. See *id.* § 1311(b)(1)(A).

644. See EPA, Policy and Guidance on Mixing Zones, 63 Fed. Reg. 36,788 (July 7, 1998).

645. See S. REP. NO. 92-414 (1972), reprinted in 1972 U.S.C.C.A.N. 3668, 3672.

... From its two-year study of the Federal water pollution control program, the Committee concludes that the national effort to abate and control water pollution has been inadequate in every vital aspect . . .⁶⁴⁶

So in 1972, Congress amended the FWPCA to establish continuing, albeit unequal, roles in water pollution control for the states and the federal government.⁶⁴⁷ While their powers overlap in this environmental management pas de deux, each has been given a basic tool with which to work.

First, the EPA is required to adopt industry-wide standards of performance for dischargers based on existing economically achievable technologies.⁶⁴⁸ The application of these performance standards, or effluent guidelines, leads to the assignment of discharge permits under the NPDES permitting program.⁶⁴⁹ Effluent limitations are defined by the CWA as restrictions on the rate, concentrations, and quantities of pollutants that may be discharged into public waters.⁶⁵⁰ They are established without regard to the quality of the receiving water. Second, the states continue to maintain sway over the application of water quality standards through determinations of specific pollutant concentrations and limits that may exist in a waterbody and still allow for the enjoyment of the water's beneficial uses.⁶⁵¹ The hierarchy of these two philosophically opposed approaches was clearly delineated by Congress as follows: "[u]nder this Act the basis of pollution prevention and elimination will be the application of effluent limitations. Water quality will be a measure of program effectiveness and performance, not a means of elimination and enforcement."⁶⁵²

A key principle of the NPDES permitting program is that when technology-based effluent limits are incapable of achieving WQS, the failure is to be remedied by the imposition of additional limits based on WQBEL. As described earlier, sections 301 and 302 of the CWA lay out the legal framework for developing WQBEL.⁶⁵³ Because WQBEL are only imposed after a determination that technology-based guidelines will not achieve WQS, they are often characterized as secondary or supplemental to the technology-based permitting

646. *Id.* at 3672, 3674.

647. *See generally* 33 U.S.C. §§ 1311, 1313, 1342.

648. *See id.* § 1311(b)(2)(A).

649. *See id.* § 1342(a)(1).

650. *See id.* § 1362(11).

651. *See id.* §§ 1313(a), 1313(c)(2).

652. S. REP. NO. 92-414 (1972), *reprinted in* 1972 U.S.C.C.A.N. 3668, 3675.

653. *See* 33 U.S.C. §§ 1311-1312. The history of water regulation is discussed in Part II.B.

mechanism.⁶⁵⁴ In fact, the NPDES permitting system could not be more dependent upon WQBEL to fulfill the objectives of the CWA.

Technology-based limits are adopted for entire classes and categories of dischargers after an extensive public process.⁶⁵⁵ They must account for a wide range of capabilities and situations within each industry and are unavoidably influenced by politics and economics. It is common for technology-based limits to be significantly less stringent than limits developed directly from WQS, because the latter reflect scientifically derived criteria that do not consider costs to any individual or group of dischargers.⁶⁵⁶ However, the typically more stringent WQS are not translated directly into WQBEL. Every state has adopted discretionary policies that provide for the application of mixing zone dilution factors.⁶⁵⁷ Because the resulting WQBEL are often less stringent than the technology-based effluent limits, many permits consist of a majority of technology-based limits.⁶⁵⁸ In practice, it is common for permits to only “achieve” WQS because the WQS have been modified by dilution factors that may range over several orders of magnitude. Therefore the notion that WQBEL based on WQS function as a backup to the technology-based effluent limits program is often, for all practical purposes, meaningless.

Congress intended the Act to “restore the balance of Federal-State effort in the program.”⁶⁵⁹ Ironically, because states are responsible for adopting the WQS upon which the WQBEL are derived in the development of NPDES permit limits, the balance of power between the federal government and the states may not reflect the scenario anticipated by Congress. The ultimate success of the federal pollution control system to restore and maintain uses in public waters is dependent upon state-based choices of the uses to be protected and the ability of state regulators to accurately predict the long-term effects of polluted discharges. This was of course the very system deemed unworkable by Congress, due to the difficulty of having individual states establish effluent limitations on the basis of instream water quality. As a result, given the assumptions and uncertainty in every state-driven mixing zone analysis, fulfilling the

654. See 33 U.S.C. § 1311(b)(1)(C).

655. See *id.* § 1316(b)(1).

656. Compare *id.* § 1311(b)(2)(A), with *id.* § 1313(d)(1)(D).

657. See *Puerto Rico Sun Oil Co. v. EPA*, 8 F.3d 73, 75 (1st Cir. 1993) (citing EPA, MIXING ZONES—WATER QUALITY STANDARDS CRITERIA SUMMARIES: A COMPILATION OF STATE/FEDERAL CRITERIA 2, 70-78 (Sept. 1988)).

658. See, e.g., EPA NPDES Permit No. AK-002324-8 (July 1996).

659. S. REP. NO. 92-414 (1972), reprinted in 1972 U.S.C.C.A.N. 3668, 3675.

goal of the Act to protect the uses of public waters remains far more a matter of policy and economics than science.

Nevertheless, mixing can occur without precluding of uses. The second question remains: did Congress intend to insure that existing uses would be met in all portions of all waters? Evidence against the notion that Congress intended to permit states to sacrifice uses in portions of waters is found in section 302 of the CWA.⁶⁶⁰ Under *Water quality related effluent limitations*, the Act requires that additional effluent limitations and strategies be established when the limits required under section 301 are insufficient to maintain water quality capable of protecting the uses in *specific* portions of the navigable waters.⁶⁶¹ A plain reading of this section of the Act demonstrates that Congress meant to insure that all portions of the nation's waters receive the protections necessary to maintain existing uses.

The protection of uses in all waters is further supported by the federal Antidegradation Policy (ADP).⁶⁶² The least stringent subsection of the ADP policy, known as "Tier 1" protection, stipulates that existing uses of the water, and the water quality necessary to protect those uses, must be maintained and protected.⁶⁶³ There is no caveat in this regulation suggesting that it does not apply to waters within mixing zones.⁶⁶⁴ In fact, Alaska felt compelled to specifically modify its ADP to remove protections for the water column within mixing zones and above a "zone of deposit."⁶⁶⁵

The ADP's more stringent "Tier 2" antidegradation protection allows for a lowering of water quality when necessary to serve important social or economic activities, but only when the water quality exceeds the levels necessary to enjoy the existing uses.⁶⁶⁶ The "Tier 2" subsection of the ADP explicitly states that lowering water quality beyond the point of protecting existing uses is prohibited.⁶⁶⁷

Despite the language in the federal ADP and section 302 of the CWA, the EPA mixing zone regulations and every state, tribal, and territorial mixing zone regulation allow pollutant concentrations to

660. See 33 U.S.C. § 1312(a).

661. See *id.*

662. See Antidegradation Policy, 40 C.F.R. § 131.12 (1999).

663. See *id.* § 131.12(a)(1) (2000).

664. See *id.* § 131.12.

665. See ALASKA ADMIN. CODE tit. 18, § 70.015(a)(2) (2000).

666. See 40 C.F.R. § 131.12(a)(2).

667. See *id.*

exceed WQS criteria within mixing zones.⁶⁶⁸ Not only are chronic aquatic life criteria continually exceeded, acute aquatic life criteria are exceeded as long as “acutely toxic conditions” are not expected to impact selected organisms exposed for some arbitrarily determined length of time. By definition, when criteria are exceeded, uses are removed.⁶⁶⁹

Congress recognized in 1972 that some pollution of public waters must continue to be tolerated, and presumably it reasoned that some mixing of polluted wastestreams and receiving waters was physically inevitable.⁶⁷⁰ Although the Act is relatively quiet on the issues of mixing and dilution, Congress did prohibit the use of dilution as a substitute for other methods of treatment.⁶⁷¹ Even so, the courts have never directly evaluated whether the authorization of dilution in mixing zones is consistent with the CWA. The judicial record is not, however, completely void of comments on the use of dilution for waste treatment.

In *Ford Motor Co. v. EPA*, the issue of flow augmentation, a dilution-based treatment mechanism somewhat analogous to mixing zones, was discussed at length.⁶⁷² The court noted a memorandum drafted by the EPA Office of General Counsel that acknowledged the Act’s limited guidance on the use of flow augmentation, as well as the EPA’s negative attitude toward the use of dilution when all other potential abatement mechanisms had not been employed.⁶⁷³ Nonetheless, the court determined that the EPA’s restriction on flow augmentation in Ford’s NPDES permit was not based on “any ‘guidelines or requirements’” that had not been subject to proper public notice and comment procedures.⁶⁷⁴

A dissenting commentary addressing the broader issue of dilution submitted in that case is worth reviewing. The dissenting opinion on dilution-based treatment was based on the judge’s view that “it is precisely because flow augmentation is not specifically approved as a means of achieving acceptable concentrations under Michigan’s water quality standards that the EPA is justified in

668. See EPA, WATER QUALITY STANDARDS HANDBOOK 5-1 to 5-9 (2d ed. 1994); see also *Puerto Rico Sun Oil Co. v. EPA*, 3 F.3d 73, 75 (1st Cir. 1993).

669. See EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, GLOSS-3.

670. See, e.g., Clean Water Act, 33 U.S.C. § 1311(b) (1994). The various standards continue to allow for discharge.

671. See *id.* § 1252(b)(1).

672. See 567 F.2d 661, 665 (6th Cir. 1977).

673. *Id.* at 670.

674. *Id.* at 671-72.

intervening.”⁶⁷⁵ Although this statement supports the use of dilution to meet water quality standards if a state has chosen to accept such a treatment regime, it must be remembered that states are not permitted to adopt water quality regulations in a vacuum. The EPA reviews all state submissions of water quality standards and would also have had to accept that flow augmentation was consistent with the CWA.⁶⁷⁶ The dissenting judge did not believe that Congress assumed the EPA would anticipate all potential treatment proposals and pass judgment for or against every procedure in advance of its appearance in a permit application. He contended that Congress’s intent was quite the opposite; ergo the CWA’s prohibition of discharges that do not comply with applicable sections of the Act.⁶⁷⁷

The judge further noted that without a regulatory limit on the amount of water that a discharger could remove for flow augmentation purposes, any volume of water could be diverted for purposes of dilution.⁶⁷⁸ Water quality standards could therefore theoretically always be met without any reduction in the amount of pollutants released.⁶⁷⁹ Effluent limitations are concerned with amounts as well as concentrations, and as demonstrated in the following excerpts from the dissenting opinion, flow augmentation or any dilution-based treatment mechanism may therefore in fact not be legal under the CWA:

While it is not necessary to hold that flow augmentation is implicitly forbidden by the FWPCA, there is much within the Act and its history to support such a view. . . .

. . . .
 . . . The statute, needless to say, does not speak in terms of dilution. . . . Flow augmentation, it is agreed, simply reduces the concentration of pollutants introduced into a body of water. It does not, however, eliminate or reduce the quantity of the pollution. . . .

. . . .
 . . . The conclusion is inescapable that the drafters of the FWPCA did not intend industrial dischargers of waste materials from point sources such as Ford’s Raisin River plant to achieve statutory compliance by using dilution as a substitute for waste treatment.⁶⁸⁰

Furthermore, the dissenting judge noted that similar issues had been raised in the court’s interpretation of the Clean Air Act. The

675. *Id.* at 673 (Engel, J., dissenting).

676. *See* 33 U.S.C. § 1313.

677. *See id.* § 1311(a); *Ford*, 567 F.2d at 673 (Engel, J., dissenting).

678. *Ford*, 567 F.2d at 672 (Engel, J., dissenting).

679. *See id.*

680. *Id.* at 673-74.

judge noted that “the Fifth Circuit determined that the use of tall smokestacks merely achieved a dispersion of pollutants and did not limit the quantities emitted. The ‘tall stacks’ technique was judged to be an inadequate means of attaining national primary ambient air quality standards.”⁶⁸¹ National ambient air standards closely resemble state-based ambient water quality standards. Both are concerned with amounts of pollutants in a given volume of their respective media, rather than the discharge from any particular source.⁶⁸² According to the dissenting opinion in *Ford*, “[f]low augmentation is analogous to the use of tall stacks in that it facilitates the dispersion of pollutants but does not reduce the quantity disseminated into the waters.”⁶⁸³ The same arguments could be forwarded with respect to mixing zones. For example, in Alaska, pollutant concentrations are usually the limiting factor in mixing zone development.⁶⁸⁴ Therefore, receiving waters of sufficient volume could enable any effluent of virtually any characteristics to be legally discharged. While this may result in acceptable concentrations of pollutants, it does not address the issue of pollution abatement.

In closing, the dissenting judge returned to the problem of adopting rules that allow pollutant dilution by stating that “[i]t is not for us to speculate that the Administrator approved or would have approved the use of flow augmentation, when such an inference is obviously inconsistent with the objectives of the Act and results in a strained construction of the water quality standards themselves.”⁶⁸⁵

Unfortunately, neither the majority decision reached in *Ford*, nor the minority dissenting opinion, clearly discerns Congress’s intent regarding the use of dilution. For that matter, it is unknown whether Congress was cognizant in 1972 of the degree to which dilution would in the future be applied to avoid meeting WQS by the same state administrations that had failed to protect the nation’s waters prior to passage of the CWA.⁶⁸⁶

The presumption by state and federal administrations that the CWA permits water quality to be lowered to the point of exceeding criteria and removing uses in mixing zones remains highly debatable. Therefore the second question, concerning the end result that Congress may have envisioned for dilution-based treatment

681. *Id.* at 675 (citing *NRDC v. EPA*, 489 F.2d 390, 410-11 (5th Cir. 1974)).

682. *See id.* at 675 n.8.

683. *Id.* at 675.

684. *See ALASKA ADMIN. CODE* tit. 18, § 70.245(b)(7).

685. *Ford*, 567 F.2d at 677 (Engel, J., dissenting).

686. *See S. REP. NO. 92-414* (1972), *reprinted in* 1972 U.S.C.C.A.N. 3668, 3671-72.

mechanisms under the CWA, remains unanswered. State and federal regulators have conjectured unofficially that mixing zones may have no legal basis.⁶⁸⁷ Yet no public record was unearthed during the course of this investigation to document that any administration has questioned the right to authorize mixing zones after the passage of the CWA. Perhaps even more telling, regulators approached in Alaska were able to recall only one denial of a mixing zone application in the history of the state's program.⁶⁸⁸

In theory, all water pollution can be eliminated. The crux of the issue is not whether polluted discharges can be eliminated, but how much society is willing to pay to do so, and at what point society determines that to do better costs more than the benefit is worth. To address the issue of cost, many mixing zone regulations require that mixing zones be as "small as practicable."⁶⁸⁹ In theory, policies that require small mixing zones force dischargers to employ additional treatment mechanisms to reduce the concentration of pollutants at the point of discharge. But mixing zone applications are specific to a particular discharger, and practicability is defined on the economic strength of the applicant. Additional treatment may cost millions of dollars. Sometimes it is required, sometimes not. Nevertheless, while the release of chronically or acutely toxic concentrations of pollutants into public waters may be practicable for the discharger, it may be impractical for the rest of society. The application of a mixing zone dilution factor has no doubt resolved many disputes over pollution restrictions between dischargers and regulators, but the practice may have survived at the public's expense. Substantial costs are incurred by regulating authorities during the design phase of mixing zones. A thorough mixing zone investigation is no small undertaking, requiring oceanographic and water column analysis, tracer studies that account for weather, tidal and seasonal variations, biological inventories, impact/risk predictions, and detailed engineering plans.⁶⁹⁰ Although a portion of the costs is often borne by the applicant, the time and resources expended by the states and the EPA to help design and review these materials can be significant.

It is likely that a lack of financial and technical resources, and the desire to avoid some of these costs is at least partially responsible for the *laissez-faire* attitude employed by many states today in the

687. See Telephone Conversation with Rick Albright, Director, EPA Alaska State Office (Jan. 1999) (on file with author).

688. See Letter from Kenwyn George, *supra* note 445, at 2.

689. See, e.g., ALASKA ADMIN. CODE tit. 18, § 70.240(a)(2).

690. See, e.g., EPA NPDES Permit No. AK-002324-8 (July 1996).

assignment of mixing zones. To avoid expensive, time-consuming site-specific mixing zone analyses, some states use generic mixing zone restrictions, especially in lakes or streams, based on size limits and available dilution volumes.⁶⁹¹ The dimensions of these mixing zones are typically determined by some arbitrary percentage of the cross-sectional length of the waterbody, or by a simple ratio of effluent volume to receiving water volume.⁶⁹² By granting mixing zones without site-specific evaluations, states are demonstrating a preference for applying dilution factors to WQS rather than requiring more treatment of wastestreams or operational changes that reduce pollutant production outright. Generic mixing zone rules typically fail to forecast the mixing zone's potential impact on the greater ecosystem.

It is indisputable that the purpose of the CWA is to protect the nation's waters from pollution, not to insure the right to discharge. The CWA declares that "except as in compliance with . . . this title, the discharge of any pollutant by any person shall be unlawful."⁶⁹³ The fulfillment of that provision is not a straightforward affair, and the addition of mixing zone regulations to the larger water quality standards equation has substantially complicated an effort that regulators already consider remarkably complex.⁶⁹⁴ Mixing zones have been aptly described as "the wildest card of all."⁶⁹⁵ Despite language in federal regulation granting authority to the EPA, states, tribes, and territories to develop mixing zone regulations, this authority may not necessarily provide the discretionary power to use mixing zones to circumvent otherwise applicable water quality standards and federal criteria in public waters.⁶⁹⁶

The EPA's adoption of the "waterbody-as-a-whole" principle has provided for the selective sacrifice of portions of waters. To some degree, this policy has effectively allowed the agency to administer water quality protection within the context of the FWPCA of 1948 rather than on the fundamental goals and objectives of the CWA as adopted in 1972. In accordance with its own regulations, and as reviewer of WQS submissions for consistency with the CWA, the EPA

691. See, e.g., ALASKA ADMIN. CODE tit. 18, § 70,255(e).

692. See *id.*

693. Clean Water Act, 33 U.S.C. § 1311(a) (1994).

694. See EPA, WATER QUALITY STANDARDS HANDBOOK, *supra* note 1, at 5-1 to 5-2.

695. Houck, *supra* note 55, at 10,545.

696. See EPA Water Quality Standards, 40 C.F.R. § 131.13 (2000).

should reject mixing zone policies that do not prevent uses from being precluded in all portions of public waters.⁶⁹⁷

The widespread and indiscriminant use of mixing zones clearly has the potential to thwart the greater goals of the CWA. A fundamental purpose of the Act's NPDES permitting mechanism is to insure that as more efficient, less waste-producing technologies are developed, they become incorporated into revisions of the national effluent guidelines.⁶⁹⁸ These improved standards, applied category-wide under the best conventional and best available technology stipulations in section 306, are intended to reduce the magnitude and frequency of polluted discharges and bring the nation closer to the zero-discharge goal.⁶⁹⁹ Yet virtually automatic renewals of mixing zones without a compelling demonstration of need or impacts to the public's resources assure the availability *ad infinitum* of public waters for dilution and removes a major incentive to design and implement technologies that will improve performance. Put bluntly, the routine application of mixing zones directly undermines the mechanisms by which the zero-discharge goal of the CWA might otherwise be met.

Until the zero-discharge goal is achieved, the CWA and regulations that implement it must continue to provide a mechanism for the discharge of pollutants, albeit in a manner that insures that the beneficial uses of the nation's waters are protected. Therefore, there will continue to be mixing zones between wastestreams and receiving waters for some time to come.

The following list of policies, evaluation criteria, and prohibitions represent a set of rules that would continue to permit some mixing to occur while maintaining a position consistent with the goals and principles of the Act and other federal regulations until the zero-discharge objective is achieved.

- Mixing zones must be explicitly authorized as a potential regulatory mechanism by each state, tribe, and territory for use in their respective waters.
- Minimum in-zone levels of water quality should not exceed chronic and acute aquatic life criteria and human health criteria, thereby insuring beneficial uses of all waters are maintained or restored.

697. See 33 U.S.C. § 1313(c)(2).

698. See *id.* §§ 1313(b)(1)(A), 1311(b)(2)(A), 1311(d).

699. See *id.* § 1316.

- Use classes (e.g., drinking water, primary recreation, fish spawning areas, etc.) off-limits to mixing zones should be identified.
- Mixing zones should be prohibited in areas where they may impact threatened or endangered species.
- Mixing zones should be prohibited for pollutants that attract resident or aberrational species.
- Mixing zones should be prohibited in waters listed as impaired under section 303 of the CWA.⁷⁰⁰
- Protocols should be adopted to address the impacts of multiple mixing zones and multiple pollutant mixing zones in a waterbody.
- Individual pollutants and categories of pollutants should be identified that may not receive mixing zone allocations (e.g., persistent organic pollutants, bioaccumulative chemicals of concern, carcinogens, mutagens, and teratogens).
- Chronic, long-term toxicity testing protocols should be used to identify biological, chemical, and physical impacts to the most sensitive members of the aquatic community including sessile, nonmotile species, free swimming and drifting species – for both existing and subsequent generations.
- Mixing zone applications should provide site-specific analyses that consider size, shape, length, appropriate flow models, and placement restrictions to anticipate nearby uses that may be compromised.
- Existing protocols should be used to estimate health risks and exposure pathways to humans and aquatic organisms and be factored into determinations of appropriateness, size, configuration and placement of mixing zones.
- Existing protocols should be used to determine the potential for complete or incomplete mixing, and mixing zones should be prohibited where complete and rapid mixing is not anticipated.
- Proposed mixing zones should be evaluated for their potential interaction with other point and nonpoint sources of pollution in the waterbody, and limits placed on the total cumulative impacts from multiple sources.
- Protocols should be established for identifying the impact of a proposed mixing zone on other waste load allocations in the

700. See *id.* § 1313(d)(1)(A).

waterbody and factored into Total Maximum Daily Load calculations.

- Minimal requirements should be established for gathering baseline data on the ecosystem prior to the approval of a mixing zone.
- Modeling and on-site dispersion testing should be required before a mixing zone is authorized and throughout the life of the mixing zone.
- Social and economic benefits analyses must be performed to satisfy the Antidegradation Policy's requirement for "need" when lowering water quality, and industry-wide standards defining economic necessity should be established.
- Procedures for public notification and comment, publication of fact sheets including an analysis of economic necessity, the expected biological consequences, and the potential reduction in uses, must exist before a mixing zone is authorized.
- Waters containing mixing zones should be posted to insure an informed public.
- Monitoring requirements and enforcement procedures should insure that mixing zones perform as anticipated and establish procedures to modify or eliminate mixing zones when pollution impacts exceed water quality standards or federal criteria.
- Comprehensive plans should be adopted to require the reduction or elimination of mixing zones in future NPDES permit renewals.

The short-term incentive for employing mixing zones is largely financial. However, the development of better treatment technologies would likely provide greater financial benefits to society because the economic value of clean water will only increase over time. Cleaner technologies and more efficient treatment systems will be commodities of tremendous value to the patent holder, as well as to any industry that can operate in greater harmony with society's other needs for its aquatic resources. Preventing pollution is a far cheaper alternative to mitigating pollution. The issue is not *if* one pays, but *when* one pays. No society escapes the costs of polluting its water forever.

Nearly three decades after the passage of the CWA, dilution is still the solution to pollution in many waters across the United States. Given the public's interest in water quality protection, the use of mixing zones, especially for toxic chemicals, might not be condoned

if people were aware of the extent of their existence. Regardless of the public's awareness, or lack thereof, it can be argued that current mixing zone policies thwart Congress's intent in passing the CWA. Mixing zones appear to be fundamentally inconsistent with the primary goal of the Clean Water Act—to restore and maintain the biological, physical, and chemical integrity of the nation's waters.