

Issuing Violations Without Tangible Evidence: Computer Modeling for Clean Water Act Enforcement

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ABSTRACT: The Environmental Protection Agency (“EPA”) often uses computer modeling as evidence to enforce the Clean Water Act. Sometimes, the EPA uses the modeling as its sole source of evidence when citing a violation, neglecting to ever obtain tangible evidence, such as water samples, for testing. This Note advocates that the EPA abandon computer modeling as a device used to prove Clean Water Act violations. Computer modeling may remain a tool for the advancement of science and a planning mechanism to create National Pollutant Discharge Elimination System permits; however, computer modeling should stay outside of the enforcement sector of the Act.

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I. INTRODUCTION

Environmental regulation in the United States has a short history.¹ Before the federal government enacted the Water Pollution Control Act (“WPCA”) in 1948,² the federal government had not funded any state water-pollution-control programs.³ The WPCA marked the federal government’s first serious attempt to address some of the country’s water-pollution problems,⁴ authorizing the Surgeon General of the Public Health Service to produce plans to reduce or completely eliminate the nation’s water pollution.⁵ The Act authorized federal funds for states and municipalities to construct sewage-treatment facilities, in order to prevent human waste from entering the nation’s water sources.⁶

Though the WPCA set initial standards for water-pollution control, the American people and federal government demanded more regulation as they became increasingly aware of and educated about water pollution. To address these growing concerns, Congress first passed a series of amendments to the WPCA.⁷ Those concerns grew to crisis proportions by the 1970s when an Ohio river burst into flames due to its level of oil and industrial waste and after Ralph Nader issued a report⁸ bringing to light the

1. See ROBERT W. ADLER, *THE CLEAN WATER ACT 20 YEARS LATER* 6 (1993) (noting that regulation began in the middle of the twentieth century).

2. A. Myrick Freeman III, *Water Pollution Policy*, in PUBLIC POLICIES FOR ENVIRONMENTAL PROTECTION 169, 172 (Paul R. Portney & Robert N. Stavins eds., 2000); EPA, History of the Clean Water Act, <http://www.epa.gov/lawsregs/laws/cwahistory.html> (last visited Jan. 25, 2010) [hereinafter History of the Act].

3. ADLER, *supra* note 1, at 6.

4. *Id.*

5. U.S. Fish & Wildlife Serv., Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service: Federal Water Pollution Control Act (Clean Water Act), <http://www.fws.gov/laws/lawsdigest/FWATRPO.HTML> (last visited Jan. 23, 2010).

6. *Id.*; ADLER, *supra* note 1, at 6.

7. ADLER, *supra* note 1, at 5–6. For a summary of these amendments, see Freeman, *supra* note 2, at 172–73. These amendments resulted in the WPCA’s renaming to the “Federal Water Pollution Control Act” or “FWPCA.” *Id.*

8. ADLER, *supra* note 1, at 5; Jack Lewis, *The Spirit of the First Earth Day*, EPA J., Jan.–Feb. 1990, at 8, 8 (describing how “Cleveland’s Cuyahoga River, an artery inundated with oil and toxic chemicals, burst into flames by spontaneous combustion”); see DAVID ZWICK & MARCY BENSTOCK, *WATER WASTELAND: RALPH NADER’S STUDY GROUP REPORT ON WATER POLLUTION* chs. 2–5 (1971) (discussing American water-pollution problems, specifically municipal and industrial dangers and federal water-quality standards through anecdotes and scientific studies). Examples of these individual problems include the following:

- The Department of Health, Education and Welfare’s Bureau of Water Hygiene reported in July 1970 that 30 percent of drinking water samples had chemicals exceeding the recommended Public Health Service limits. The Detroit River contained six times the Public Health Service limit for mercury.

water-pollution problem's severity by examining individual pollution instances.⁹ All of this led to the Federal Water Pollution Control Act ("FWPCA")'s most substantial amendments in the 1970s, when the FWPCA became known as the Clean Water Act ("the Act" or "CWA").¹⁰

The CWA gave the EPA extensive enforcement authority¹¹ because the CWA never expressly articulated how the EPA should regulate it or what was required for the EPA to issue a violation.¹² Today, the Act states that an EPA administrator should make a citation-issuance determination based on "any information available to him,"¹³ but the Act does not stipulate appropriate types of evidence.¹⁴

One type of evidence that the EPA frequently uses to issue violations is computer modeling.¹⁵ This Note argues that the EPA inappropriately uses computer modeling as an enforcement tool for issuing violations under the Act, because computer modeling does not prove "actual discharge" violations as *Waterkeeper Alliance, Inc. v. EPA* requires.¹⁶ Computer modeling attempts to simulate reality based on a series of mathematical equations, but it cannot produce more than approximate results.¹⁷ Because the results may not be one-hundred-percent accurate,¹⁸ computer modeling fails to prove "actual discharge." Since computer modeling does not verify that a facility

- The Food and Drug Administration (FDA) reported in February 1971 that 87 percent of swordfish samples had mercury at levels that were unfit for human consumption.

....

- Indiana's Brandywine Creek was declared unfit for swimming in 1969. The Hudson River contained bacteria levels 170 times the safe limit.

ADLER, *supra* note 1, at 5.

9. See ADLER, *supra* note 1, at 5–6 (describing the pattern of water pollution that Nader and his researchers found).

10. History of the Act, *supra* note 2; see *supra* note 7 (describing how the WPCA became the FWPCA). This Note refers to the Clean Water Act as both "the Act" and the "CWA."

11. 33 U.S.C. § 1251(e) (2006); History of the Act, *supra* note 2; see *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 491 (2d Cir. 2005) (noting that the Clean Water Act intends to completely eliminate pollutants from the nation's waters).

12. 33 U.S.C. § 1319.

13. *Id.* § 1319(a)(1), (3), (6).

14. *Id.* § 1319(a)(3)–(6).

15. Transcript of Record at 304, *In re Lowell Vos*, No. CWA 07-2007-0078 (Sept. 15–22, 2009) (on file with the Iowa Law Review); Telephone Interview with Stephen Pollard, Case Dev./Compliance Officer, EPA (Jan. 29, 2009).

16. *Waterkeeper*, 399 F.3d at 505. On December 28, 2009, the Eighth Circuit held that the EPA can only assess monetary penalties for actual discharges within the scope of its regulatory power. *Serv. Oil, Inc. v. EPA*, 590 F.3d 545 (8th Cir. 2009).

17. William W. Doe, III & Russell S. Harmon, *Introduction to Soil Erosion and Landscape Evolution Modeling*, in LANDSCAPE EROSION AND EVOLUTION MODELING 1, 7 (Russell S. Harmon & William W. Doe, III eds., 2001).

18. See *infra* Part III.A (describing computer-modeling accuracy).

has, in fact, discharged pollutants, the EPA violates the CWA each time it uses computer modeling as its sole enforcement tool.

Part II of this Note gives a brief history of the CWA and summarizes its requirements and restrictions. Part III describes two of the computer-modeling processes the EPA often uses to issue violations. Part III also addresses the benefits and disadvantages of using computer modeling for enforcement purposes. Part IV discusses the *Waterkeeper* case, which held that the CWA gave the EPA the authority to regulate only “actual discharge,” and not potential or possible discharge.¹⁹ Part IV also discusses how *Waterkeeper* affects computer modeling as a CWA enforcement measure. Part V suggests that the EPA abandon its use of computer modeling for CWA enforcement purposes and Part VI provides potential enforcement alternatives.

II. UNDERSTANDING THE CLEAN WATER ACT

A. HISTORY

The Clean Water Act gave the EPA the authority to regulate pollution by creating wastewater standards and programs geared toward completely eliminating pollutants from the nation’s navigable waters.²⁰ It also gave the EPA the power to issue National Pollutant Discharge Elimination System (“NPDES”) permits—a major component of the EPA’s CWA regulation—which regulate the discharging of pollutants into navigable waters²¹ in the United States.²² To decide whether a facility needs an NPDES permit, or to show that a facility has violated the guidelines in its NPDES permit,²³ the EPA often uses computer modeling to determine whether, and how much, a

19. *Waterkeeper*, 399 F.3d at 505 (requiring that “actual discharge” occur before the EPA can issue a violation under the CWA).

20. 33 U.S.C. § 1251(e) (2006); History of the Act, *supra* note 2; see *Waterkeeper*, 399 F.3d at 491 (noting that the CWA intends to completely eliminate pollutants from the nation’s waters).

21. “Navigable waters” are “waters of the United States, including the territorial seas.” 33 U.S.C. § 1362(7). The EPA’s final rule defining “navigable waters” states:

(1) All navigable waters of the United States, as defined in judicial decisions prior to the passage of the 1972 Amendments to the FWPCA (Pub. L. 92-500), [also known as the Clean Water Act (CWA),] and tributaries of such waters;

(2) Interstate waters;

(3) Intrastate lakes, rivers, and streams which are utilized by interstate travelers for recreational or other purposes; and

(4) Intrastate lakes, rivers, and streams from which fish or shellfish are taken and sold in interstate commerce.

EPA Water Programs, 40 C.F.R. § 112.2 (2010).

22. EPA, National Pollutant Discharge Elimination System (NPDES), <http://cfpub.epa.gov/npdes/> (last visited Jan. 25, 2010).

23. See *infra* Part II.B (defining and describing the NPDES permit system).

facility has discharged.²⁴ By using computer modeling to prove a CWA violation, the EPA uses computer modeling as a means of enforcement.

As noted in Part I, the CWA has its origins in the WPCA of 1948,²⁵ which gave courts the power to grant relief in pollution cases.²⁶ Though the WPCA was the first time Congress addressed the water-pollution problem, it did not mark the last. Congress subsequently created a series of substantial amendments to the Act,²⁷ moving the law toward completely eliminating pollutants from the nation's navigable waters.²⁸ Today, the CWA is the leading regulating act governing water pollution.²⁹

Amendments in 1977 gave the EPA the authority to set wastewater standards and to create and apply pollution-control programs.³⁰ The changes also required that all people and businesses obtain a permit if a possibility exists that a source on their land might discharge pollutants³¹ into navigable waters.³²

Since 1977, the EPA has exercised its authority by creating and implementing several pollution-control programs and by setting water-quality standards for nearly every contaminant known to exist in U.S. navigable waters.³³ However, despite the EPA's efforts to rid the nation's waters of pollutants, recent data suggests that nearly forty percent of the nation's waters remain polluted.³⁴ The next two Sections address the EPA's

24. Transcript of Record, *supra* note 15, at 343–44 (Sandra Doty describing utilization of computer models to help EPA enforce the CWA); Telephone Interview with Stephen Pollard, *supra* note 15; *see* Doe & Harmon, *supra* note 17, at 3 (describing the research models that land-management agencies develop).

25. *See supra* Part I (discussing the CWA background).

26. Theodore L. Garrett, *Overview of the Clean Water Act*, in *THE CLEAN WATER ACT HANDBOOK* 1, 6 (Mark A. Ryan ed., 2003).

27. *See id.* at 6–7 (describing the congressional amendments).

28. *See id.* at 5–7 (summarizing the Clean Water Act's regulatory provisions).

29. 33 U.S.C. § 1251 (2006).

30. *Id.* § 1251(e); *see* History of the Act, *supra* note 2 (listing, among several other amendments in 1977, the amendment giving the EPA the authority to regulate the CWA).

31. The Act defines “pollutant” as “dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water.” 33 U.S.C. § 1362(6); 40 C.F.R. § 122.2 (2000).

32. 33 U.S.C. § 1342(a)(1); *see* History of the Act, *supra* note 2 (noting other amendments to the Act, including the creation of a structured basis for pollutant-discharge regulation, the beginning of funding for sewage-plant construction, and the beginning of regulation of nonpoint source pollution).

33. EPA, Regulatory Information by Environmental Topic, <http://www.epa.gov/regulations/envtopics/index.html> (last visited Jan. 23, 2010) (listing environmental issues and topics the EPA regulates).

34. Terence J. Centner & Theodore A. Feitshans, *Regulating Manure Application Discharges from Concentrated Animal Feeding Operations in the United States*, 141 ENVTL. POLLUTION 571, 571 (2006) (citing EPA, OFFICE OF WATER, NATIONAL WATER QUALITY INVENTORY 14, 21 (2000),

attempt to reduce pollutant quantity through NPDES permits, specifically referencing agriculture operations.

*B. REGULATING THROUGH THE NATIONAL POLLUTANT
DISCHARGE ELIMINATION SYSTEM*

The CWA ambitiously seeks to eliminate water pollution by prohibiting “any person” from discharging pollutants from any “point source”³⁵ into navigable waters,³⁶ unless the EPA or authorized agency has issued that person an NPDES permit.³⁷ The EPA manages the program and requires that “industrial, municipal, and other facilities” get a permit if their pollutant “discharges go directly to surface waters.”³⁸

The CWA broadly defines “point source” as “any discernible, confined and discrete conveyance from which pollutants are or may be discharged.”³⁹ NPDES permits limit the amount a point source can discharge into navigable waters, based on pollutant type.⁴⁰ Congress likely intended the Act to encompass pollution sources of nearly every type of pollutant,⁴¹ but the Act’s definition of point source does not include discharges that result from “agricultural storm water and irrigated agriculture return flows.”⁴² However, as discussed below, a concentrated animal feeding operation does not meet

available at <http://www.epa.gov/305b/2000report> [hereinafter NATIONAL WATER QUALITY INVENTORY]).

35. 33 U.S.C. § 1311(a).

36. For the current EPA definition of “navigable waters,” see *supra* note 21.

37. 33 U.S.C. §§ 1342, 1311(a). According to § 301(a), a person may violate the Act if he or she discharges pollutants into navigable waters and is not “in compliance with sections 302, 306, 307, 318, 402, and 404 of the Act.” Karen M. McGaffey, *Water Pollution Control Under the National Pollutant Discharge Elimination System*, in THE CLEAN WATER ACT HANDBOOK, *supra* note 26, at 9, 9. Compliance under these rules usually means obtaining an NPDES permit. *Id.*; see *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 491 (2d Cir. 2005) (articulating the goals of the Act).

38. 33 U.S.C. §§ 1342(p), 1311(a).

39. *Id.* § 1362(14) (explaining that this term “include[s] but [is] not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged”).

40. These limitations are called “effluent limitations.” *Id.* § 1362(11); *Waterkeeper*, 399 F.3d at 490 (citing *S. Fla. Water Mgmt. Dist. v. Miccosukee Tribe of Indians*, 541 U.S. 95, 124 (2004)); see *EPA v. California, ex rel. State Water Res. Control Bd.*, 426 U.S. 200, 204 n.11 (1976) (“Point sources other than publicly owned treatment works must achieve effluent limitations requiring application of the ‘best practicable control technology currently available’ . . . and application of the ‘best available technology economically achievable’” (quoting 33 U.S.C. §§ 1331(b)(1)(A), (2)(A) (1970 ed., Supp. IV))); ADLER, *supra* note 1, at 139 (discussing Best Available Technology, Best Conventional Technology, and Best Professional Judgment standards used to create NPDES permits).

41. Ronald I. Marvis, Annotation, *What Constitutes “Point Source” of Pollution Subject to Control by Provisions of Water Pollution Control Act, As Amended (33 U.S.C. § 1362(14))*, 52 A.L.R. FED. 885, § 2 (1981).

42. *Id.*

the storm water or irrigation exception and, therefore, qualifies as a point source.⁴³ NPDES permits have played an essential role in enforcing the CWA, because they set forth CWA enforcement guidelines by capping effluent limitations and defining a point source's obligations and restrictions.⁴⁴

The EPA can delegate its power to administer NPDES permits to the states.⁴⁵ For the EPA to give this power to a state, a state must first meet several EPA requirements under 40 C.F.R. § 123.63(a); to satisfy the requirements, a state must have the resources and ability to administer the program, and a plan to give appropriate penalties for enforcement.⁴⁶ If a state does not meet the requirements, the EPA can revoke that state's NPDES authority; alternatively, a state may choose to withdraw its NPDES authority.⁴⁷ It is also important to note that the EPA can still enforce the CWA in states where it has delegated its enforcement power.⁴⁸ This means that the EPA can regulate any case that it so chooses—even if a state agency has the authority to regulate the case, and that state agency has already made plans to investigate or enforce an action in that case.⁴⁹

C. DEFINING CONCENTRATED ANIMAL FEEDING OPERATIONS

An important component in enforcing the CWA is defining what qualifies as a point source. The EPA and legislatures have focused most of their pollution-control programs on limiting pollution from specific point sources, even though pollution from nonpoint sources (meaning that there is more than one type of pollution source) is growing.⁵⁰ One of the largest contributors of pollution—for both nonpoint sources and point sources—is agriculture.⁵¹ Much of the CWA focuses on point sources, and because one of the biggest contributors of pollution is agriculture, this Note focuses on agricultural point sources.

Many EPA regulatory programs target agriculture because of its profound impact on the environment—agricultural runoff is the “single

43. See *supra* text accompanying note 39 (defining point source).

44. *Waterkeeper*, 399 F.3d at 492 (citing *EPA v. California*, *ex rel. State Water Res. Control Bd.*, 426 U.S. 200, 205 (1976)).

45. 33 U.S.C. § 1342(a)(5) (2006).

46. *Id.* § 1342(b); 40 C.F.R. § 123.25 (2007).

47. 40 C.F.R. § 123.64.

48. 33 U.S.C. § 1342(i); EPA, What to Expect When the EPA Inspects Your Livestock Operation 1 (2003), <http://www.epa.gov/agriculture/factsheets/epa-305-f-03-009.pdf>.

49. *Id.*

50. CRS REPORT FOR CONGRESS, AGRICULTURE: A GLOSSARY OF TERMS, PROGRAMS, AND LAWS 11 (2005), available at <http://ncseonline.org/nle/crsreports/05jun/97-905.pdf>.

51. *Id.*

largest source of water pollution” in the nation’s navigable waters.⁵² The EPA estimated in 2000 that nearly sixty percent of the pollutants found in U.S. navigable waters could be traced to agricultural practices.⁵³ Quite often, animal feeding operations (“AFOs”) are the cause of this overwhelming contribution.⁵⁴

AFOs are facilities that keep and raise animals “in confined situations” and restrict the animals, their food, and their waste to small areas.⁵⁵ Studies suggest that AFOs account for sixteen percent of all agricultural pollution.⁵⁶ Because AFOs contribute such a large amount of pollution, concentrated animal feeding operations (“CAFOs”)—defined as either AFOs significantly contributing to America’s water pollution or large AFOs⁵⁷—are an enormous pollution-prevention priority. Since only about twenty percent of CAFOs obtained the required permits in the late 1990s,⁵⁸ many researchers have come to believe that CAFOs “unnecessarily contribut[e]” to the water-pollution problem.⁵⁹ Data suggests that agriculture is the most harmful

52. Charles Duhigg, *Health Ills Abound as Farm Runoff Fouls Wells*, N.Y. TIMES, Sept. 17, 2009, at A1, available at <http://www.nytimes.com/2009/09/18/us/18dairy.html?scp=1&sq=clean%20water%20act%20agriculture&st=cse>.

53. NATIONAL WATER QUALITY INVENTORY, *supra* note 34, at 14, 21; see Centner & Feitshans, *supra* note 34, at 571 (stating that agriculture is the leading source of impairment for rivers, streams, lakes, and reservoirs).

54. Centner & Feitshans, *supra* note 34, at 571. See generally P.A. Vadas et al., *A Model for Phosphorus Transformation and Runoff Loss for Surface-Applied Manures*, 36 J. ENVTL. QUALITY 324 (2007) (discussing phosphorous runoff in agricultural applications). Erosion is “the detachment and transport of in-situ soil particles by three natural agents—water (in liquid or ice form), wind, and gravity (down slope movement).” Doe & Harmon, *supra* note 17, at 1. When erosion occurs, one area loses soil and another gains it—whether the erosion takes place on land or in water. *Id.*

55. EPA, National Pollutant Discharge Elimination System, Animal Feeding Operations, http://cfpub.epa.gov/npdes/home.cfm?program_id=7 (last visited Jan. 23, 2010). In an AFO, people bring food to animals in a confined space, rather than having them freely roam around a pasture and eat what they can find. *Id.* According to the EPA, AFOs are technically defined as facilities where animals are “stabled or confined . . . [,] fed or maintained for a total of 45 days or more . . . [and c]rops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility.” *Id.*

56. Centner & Feitshans, *supra* note 34, at 571 (citing National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations, 66 Fed. Reg. 2960–3145 (proposed Jan. 12, 2001)).

57. EPA, Regulatory Definitions of Large CAFOs, Medium CAFOs, and Small CAFOs, http://www.epa.gov/npdes/pubs/sector_table.pdf (last visited Jan. 25, 2010) (defining different sizes of CAFOs based on the type and number of animals confined). To be a CAFO, a facility must first be an AFO. *Id.*

58. Centner & Feitshans, *supra* note 34, at 571 (citing National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitations Guidelines and Standards for Concentrated Animal Feeding Operations, 66 Fed. Reg. 2960–3145 (proposed Jan. 12, 2001)).

59. *Id.* (citing Terence J. Centner, *New Regulations to Minimize Water Impairment from Animals Rely on Management Practices*, 30 ENV’T INT’L 539, 539 (2004)).

source to our nation's waters, causing the EPA to focus much of its attention on agriculture entities, specifically CAFOs and potential CAFOs.⁶⁰

CAFOs produce millions of tons of animal manure every year.⁶¹ "When improperly managed, [this waste] can pose substantial risks to the environment and public health."⁶² Therefore, the EPA takes regulations concerning CAFO facilities seriously. As previously mentioned, the CWA considers CAFOs point-source dischargers,⁶³ and, consequently, CAFOs are required to obtain NPDES permits.⁶⁴ The EPA has specific effluent-limitation guidelines for the NPDES permits that CAFOs must obtain to comply with the Act.⁶⁵ The permits give CAFOs record-keeping requirements and instructions to control runoff from feedlots or production areas.⁶⁶

D. COMPLYING WITH THE CLEAN WATER ACT AND PREVENTING EROSION

CAFO managers and farmers often adjust their facility procedures to adhere to permit requirements or CWA provisions because their land use directly affects whether erosion or runoff will occur.⁶⁷ Not only can improper land use cause landscape-trajectory deterioration and soil loss, it

60. The harm agriculture causes is often the result of runoff from "lands under cultivation," but it also often comes from animal feeding operations. Centner & Feitshans, *supra* note 34, at 571 (citing NATIONAL WATER QUALITY INVENTORY, *supra* note 34, at 14, 21); see Centner, *supra* note 59, at 540 (indicating that agriculture may cause up to fifty-nine percent of the pollutants in the nation's navigable waters).

61. *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 493 (2d Cir. 2005) (citing National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations (CAFOs), 68 Fed. Reg. 7176, 7180 (Feb. 12, 2003) (codified at 40 C.F.R. pts. 9, 122, 123 & 412)); EPA DEVELOPMENT DOCUMENT FOR THE FINAL REVISIONS TO THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM REGULATION AND THE EFFLUENT GUIDELINES FOR THE CONCENTRATED ANIMAL FEEDING OPERATIONS 4–35 (2002); see EPA Preamble to the Final Rule, National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations (CAFOs), 68 Fed. Reg. at 7180 (estimating that CAFO facilities for livestock and poultry create approximately five hundred million tons of manure annually, which the EPA estimates to be over three times more than humans generate in the United States).

62. *Waterkeeper*, 399 F.3d at 493–94.

63. The CAFO Rule defines CAFO facilities according to 40 C.F.R. pts. 9, 122, 123, & 412. CAFO facilities are areas where animals are confined for feeding operations. EPA, About Animal Feeding Operations, <http://www.epa.gov/agriculture/anafoidx.html#About%20Animal%20Feeding%20Operations> (last visited Jan. 23, 2010). In a CAFO, agricultural workers bring food to animals in confined spaces instead of allowing animals to graze freely in open areas. *Id.*

64. See 33 U.S.C. § 1362 (2006) (including animal feeding operation in the definition of "point source"); *id.* § 1311 (prohibiting the discharge of pollutants).

65. *Waterkeeper*, 399 F.3d at 491 (citing *EPA v. California ex rel. State Water Res. Control Bd.*, 426 U.S. 200, 205 (1976)).

66. Transcript of Record, *supra* note 15, at 59.

67. See *Doe & Harmon*, *supra* note 17, at 1 (describing activities that contribute to runoff).

can also seriously impact the amount of pollutants that enter navigable waters.⁶⁸ When animal-waste runoff enters the water (whether into navigable waters, surface water, or ground water), it pollutes that water by adding “excess nutrients, organic matter, and pathogens.”⁶⁹ This pollution can be dangerous⁷⁰ and is often regulated through NPDES permits. As a result, CAFOs try to prevent it—often through an attempt to prevent erosion since erosion is a significant source of water pollution.⁷¹

III. VIOLATING THE ACT

If an enforcing agency finds a CAFO guilty of violating a provision of the Act, that facility may be subject to substantial fines amounting to thousands of dollars or jail time.⁷² As a result, CAFO administrators and farmers strive to comply with the Act’s provisions and their NPDES permits.⁷³ The EPA or a state enforcing agency often issues violations

68. *Id.* at 1–2. If erosion is severe enough, it may be impossible to repair. *Id.* at 2. Logically, if the trajectory of landscape is changed to a nearly permanent state of downhill sloping toward water sources, there will be more runoff and pollutants will get into navigable waters more often. *Id.*

69. U.S. GEN. ACCOUNTING OFFICE, ANIMAL AGRICULTURE: INFORMATION ON WASTE MANAGEMENT AND WATER QUALITY ISSUES 1 (1995), available at <http://www.gao.gov/archive/1995/rc95200b.pdf>.

70. See Duhigg, *supra* note 52 (providing examples of agriculture-pollution danger when agricultural waste makes it into tap water, including “chronic diarrhea, stomach illnesses and severe ear infections”).

71. National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal Feeding Operations (CAFOs), 68 Fed. Reg. 7176, 7181 (Feb. 12, 2003) (codified at 40 C.F.R. pts. 9, 122, 123, & 412); Vadas et al., *supra* note 54, at 324.

72. 33 U.S.C. § 1319 (2006). If a CAFO negligently violates the provisions of the Act, it is liable for fines as low as \$2500 and as high as \$50,000 per day of violation. *Id.* If a CAFO knowingly violates the Act, the operation could be subject to fines as high as \$100,000 per day of violation or face jail time. *Id.* The most severe crime, “[k]nowing endangerment,” may be punished with a fine of up to \$1,000,000 or jail time. *Id.* The EPA generates a substantial amount of money from CWA violations. For example, in 1999, the EPA received “\$7.4 million in civil penalties under the CWA, and obtained \$577 million in injunctive relief and approximately \$8.6 million in Supplemental Environmental Projects.” Beth S. Ginsberg & Jennifer E. Merrick, *Enforcement: Section 309: Civil Judicial Enforcement*, in THE CLEAN WATER ACT HANDBOOK, *supra* note 26, at 221, 222 (citation omitted).

73. The EPA takes pollutant discharge from CAFOs very seriously because they are associated with several extremely harmful pollutants and can discharge a high number of such pollutants due to the size of the operations. See *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 494 (2d Cir. 2005) (describing harmful pollutants associated with large feeding operations). Though many experts would agree that the substances in which pollutants are found can be good when applied to land because of the positive effects on plant growth, they would probably also agree that when applied “excessively” or “improperly,” the nutrients “become pollutants that can and often do run off into adjacent waterways or leach into soil and ground water.” *Id.* CAFOs typically use the process of “land application” to dispose of the animal waste created in their operations. *Id.* This process involves the spreading of waste (manure, litter, and other waste product) onto the land as fertilizer. *Id.* The procedure is a good way to reuse the

because a facility discharged pollutants into navigable waters without a permit, violated an NPDES permit provision, or violated another provision of the Act.⁷⁴

To determine whether a facility has discharged pollutants into navigable waters, the EPA often uses some sort of computer modeling.⁷⁵ It is important to note that the EPA does not have a standard, national organizational policy to use computer modeling to enforce the CWA's provisions.⁷⁶ It does, however, use computer modeling frequently; this is often because the individual examining a given operation chooses to do so, or a regional office, finding computer modeling to be helpful, develops a de facto policy to use it.⁷⁷ The EPA applies several types of computer models; the following Section focuses on two of the most widely used.

A. COMPUTER MODELING

The EPA often utilizes computer modeling to determine whether a CAFO has violated the CWA.⁷⁸ There is no standard EPA procedure to use computer modeling, but enforcing agencies often use it when there is no evidence of actual discharge.⁷⁹ The EPA uses modeling because it depicts reality.⁸⁰ Specifically, computer modeling attempts to portray reality through “mathematical representations of functions and processes” derived from scientists’ observations of nature and scientific law.⁸¹

Models generally fall into one of two categories: empirical modeling or physics-based modeling.⁸² Empirical models are typically “models developed solely . . . upon sets of behavioural rules derived from field observation or laboratory experiments and the data collected from them,” while physics-

nitrogen, phosphorus, and potassium found in the waste for a positive effect on plant growth. *Id.* (citing EPA, STATE COMPENDIUM: PROGRAMS AND REGULATORY ACTIVITIES RELATED TO ANIMAL FEEDING OPERATIONS 13 (2002)).

74. Mark A. Ryan, *Enforcement: Section 309: Civil Administrative Enforcement*, in THE CLEAN WATER ACT HANDBOOK, *supra* note 26, at 235, 235–36.

75. See Telephone Interview with Stephen Pollard, *supra* note 15 (describing the EPA’s use of computer modeling).

76. *Id.*

77. *Id.* An EPA contract with Sandra Doty, a senior engineer at the Science Applications International Corporation, to use hydraulic computer modeling on the Lowell Vos facility provides an example of the EPA’s operation-examination contracts. Transcript of Record, *supra* note 15, at 342.

78. See Transcript of Record, *supra* note 15, at 343–44, 454 (Sandra Doty describing the utilization of computer models to help the EPA enforce the CWA); Telephone Interview with Stephen Pollard, *supra* note 15 (discussing the use of computer modeling).

79. See Telephone Interview with Stephen Pollard, *supra* note 15 (describing the EPA’s use of computer modeling despite a lack of standardized procedure).

80. Doe & Harmon, *supra* note 17, at 7.

81. *Id.*

82. *Id.*

based models are “developed entirely from first-principle soil/water physics and mechanics.”⁸³

The most common type of computer modeling the EPA uses to enforce the CWA is process-based computer modeling.⁸⁴ Empirical models are typically only considered valid when data is available for the land and circumstances at issue; quite often, that information is not available when an agency examines a facility.⁸⁵ Therefore, the EPA may use process-based models to obtain the data necessary for empirical models because field testing is often considered impractical.⁸⁶ To provide a better understanding of exactly how and when the models are used, this Section describes two common computer models that the EPA or its agents have used to enforce the Act: the Agricultural Policy/Environmental EXtender (“APEX”) and the Soil and Water Assessment Tool (“SWAT”).⁸⁷

APEX was designed to exemplify nutrient discharges from animal facilities, “specifically feedlot[s].”⁸⁸ Engineers often use APEX to determine the feedlot’s flow and nutrient discharge to a water source.⁸⁹ The APEX model estimates the amount of nutrients or pollutants, primarily nitrogen and phosphorus, that a point source is expected to discharge.⁹⁰ It “operates on a daily time step and simulates the impact of different manure management practices, tillage operations, conservation practices, and other management practices on edge-of-field indicators such as flow, sediment losses, and nutrient losses.”⁹¹ This means APEX ultimately uses four data types to generate its results: weather, soil, cover, and topography.⁹² An APEX model could probably find this information in surveys or reports that

83. *Id.* Physics-based models use theoretical principles of physics like the “conservation of mass (*continuity*), Newton’s second law of motion (*momentum*), and the first law of thermodynamics (*energy*).” *Id.*

84. Transcript of Record, *supra* note 15, at 467–70.

85. *Id.* at 467–68.

86. *Id.* at 384.

87. *Id.* at 364.

88. *Id.* at 368.

89. Transcript of Record, *supra* note 15, at 365.

90. *Id.* at 366.

91. Phillip W. Gassman et al., *Alternative Practices for Sediment and Nutrient Loss Control on Livestock Farms in Northeast Iowa*, 117 AGRIC., ECOSYSTEMS & ENV’T 135, 137 (2006). See generally Jimmy R. Williams & R.C. Izaurrealde, *The APEX Model*, in WATERSHED MODELS 437 (Vijay P. Singh & Donald K. Frevert eds., 2006) (giving an overview of the APEX model by Jimmy R. Williams, the man who invented it).

92. Transcript of Record, *supra* note 15, at 370. The cover parameters are typically used to describe what is actually visibly covering the land. For example, is the soil bare, or are there plants growing on the land and of what type? *Id.* Basically, the cover parameter examines what is growing on the land, what type of precipitation is on it, and the type of landscape. *Id.* at 371.

organizations such as the Natural Resources Conservation Service or the National Land Cover Database prepare.⁹³

The second popular model, SWAT, is similar to the APEX model, but was designed for and is used “on a larger scale.”⁹⁴ Engineers who use SWAT employ the method to calculate runoff and water from rural watersheds.⁹⁵ “Daily weather inputs” are a major factor used in the model, but it uses “soils, topography, land use, and management practices” as well.⁹⁶ Someone examining a facility for violations will often first use a model like APEX to estimate the environmental impacts feedlots will have and to account for individualized parameters (like manure management and land-application patterns) to ensure greater accuracy.⁹⁷ Then that person will administer a SWAT-type model using the figures obtained from the APEX application.⁹⁸

B. WHY USE COMPUTER MODELING?

Despite computer models’ shortcomings, they have many benefits. Computer modeling is not used in every discharge situation, and there is not a computer-modeling national standard that the EPA enforces. However, the EPA uses computer modeling frequently—often after circumstantial evidence shows that discharge *probably* occurred.⁹⁹ There are several reasons the EPA may choose to use computer modeling to issue CWA violations. First, computer models compile complex interactions in the soil and environment,¹⁰⁰ thereby removing work for the administrator and a high probability for human error. Another reason is that scientists and engineers have researched, reviewed, and improved computer models several times since their conception in the 1970s.¹⁰¹ With advances in technology, computer models have become faster and can handle more information.¹⁰² These advances have aided scientists and engineers in creating new

93. *Id.* To examine topographic information, a hydrologist may look at either a paper or digital survey of the land through a Digital Elevation Model (“DEM”). DEMs are easily accessible to the public through both the U.S. Geological Survey website and ground surveys done by agricultural or environmental organizations, such as the EPA. A hydrologist may choose to personally take measurements of the land to verify that they are consistent with the DEM measurements. *Id.* at 372–73.

94. *Id.* at 430.

95. Jennifer Benaman et al., *Calibration and Validation of Soil and Water Assessment Tool on an Agricultural Watershed in Upstate New York*, 10 J. HYDROLOGIC ENGINEERING 363, 364 (2005).

96. Gassman et al., *supra* note 91, at 137.

97. *Id.* at 137–38.

98. *Id.*

99. Telephone Interview with Stephen Pollard, *supra* note 15.

100. *See* Doe & Harmon, *supra* note 17, at 7 (discussing the components and mathematics performed in computer modeling).

101. Transcript of Record, *supra* note 15, at 366–68.

102. *Id.* at 367.

computer models and improving and modifying old ones, and have therefore made computer models more capable of broad usage.¹⁰³

Another reason the EPA might use modeling is that the models seem to generate fairly accurate results.¹⁰⁴ Studies have indicated that models like SWAT and APEX can produce results that are accurate within twenty percent of the results agents would observe in the field.¹⁰⁵ However, computer-model results can also be inaccurate by as much as fifty percent.¹⁰⁶ Even so, the models seem to be heavily validated—there are over one hundred peer-reviewed articles that claim the SWAT model’s validity.¹⁰⁷

Another reason the EPA might use modeling is because many factors used in the model can be determined on an individual basis, meaning that the parameter information an engineer inputs is the most specific

103. *Id.* Scientists developed APEX from the Environmental Policy Impact Climate (“EPIC”) model. Gassman et al., *supra* note 91, at 137. Scientific articles refer to EPIC as both the Erosion Productivity Impact Calculator model and the Environmental Policy Impact Climate model in. Philip W. Gassman et al., *Historical Development and Applications of the EPIC and APEX Models 1* (Ctr. for Agric. & Rural Dev., Working Paper No. 05-WP 397, 2005), available at <http://www.card.iastate.edu/publications/DBS/PDFFiles/05wp397.pdf> [hereinafter Gassman et al., *Historical Development*]. Because EPIC was initially used to evaluate soil-erosion impacts on certain land regions, it was referred to as the Erosion-Productivity Impact Calculator. *Id.* However, as EPIC evolved, scientists used it for other purposes involving “water quality and atmospheric CO₂ change[s],” and eventually referred to the model as the Environmental Policy Impact Climate model. *Id.* APEX’s modification of EPIC can be used for “multi-field configurations including whole farms and small watersheds” and simulates the effects of various agricultural practices. Gassman et al., *supra* note 91, at 137.

104. See V. Chaplot et al., *Predicting Water, Sediment and NO₃-N Loads Under Scenarios of Land-Use and Management Practices in a Flat Watershed*, 154 WATER, AIR, & SOIL POLLUTION 271, 283 (2004) (noting the “overall accuracy of SWAT in predicting monthly water and [nitrate nitrogen] fluxes at the study watershed outlet”).

105. SCI. APPLICATIONS INT’L CORP., MANURE DISCHARGE REPORT, LOWELL VOS FEEDLOT, KINGSLEY, IOWA 10 (2008) (prepared for the EPA); see D.D. Bosch et al., *Evaluation of the SWAT Model on a Coastal Plain Agricultural Watershed*, 47 TRANSACTIONS AM. SOC’Y AGRIC. ENGINEERS 1493, 1505 (2004) (concluding that SWAT generated results that were typically within twenty percent of observed water balances).

106. See Benaman et al., *supra* note 95, at 372 (indicating that SWAT results may be up to fifty-percent inaccurate when compared to the observed results).

107. Transcript of Record, *supra* note 15, at 368–69. See generally Centner, *supra* note 59 (discussing the newly revised CAFO standards, the management systems producers have implemented in response to the new standards and the environmental benefits that will result from the implementation of such systems); Centner & Feitshans, *supra* note 34 (discussing the new CAFO standards and highlighting a case in which the court affirmed that land-application discharges are included within agricultural storm water discharges for purposes of enforcing new CAFO standards); Gassman et al., *supra* note 91 (analyzing the effectiveness of various structural and managerial practices on AFOs in northeast Iowa); Vadas et al., *supra* note 54 (explaining a new model for detecting phosphorus runoff from surface-applied, unincorporated manures); Gassman et al., *Historical Development*, *supra* note 103 (discussing the historical development of the EPIC and APEX models and providing various examples of the application of each model).

information available that pertains to a facility.¹⁰⁸ For example, when asked for the soil-type parameter in a model, an engineer plugs in the land's soil type based on available records and history.¹⁰⁹ Although the model does not take information about the soil's present condition, it uses the most specific data available—the more specific the data, the more accurate the results.¹¹⁰

Other individualized parameters may include the management and weather parameters.¹¹¹ The management parameter is where a computer-modeling administrator uses information about the number of livestock head a facility had, how often they were present, etc.¹¹² The weather parameter is applied to integrate daily weather information into the model so that weather conditions—such as precipitation load and type—and temperatures are taken into account.¹¹³ Since scientists and engineers boast about computer models' accuracy, have validated computer models in numerous peer-reviewed articles, and can individualize data to a certain extent, hydrologists and engineers consider the computer models trustworthy.¹¹⁴

The EPA also enjoys a logistical benefit by using computer modeling. An EPA agent cannot be available every time a point source has a discharge, and the organization does not expect a state agency to handle every case in which the EPA misses a discharge.¹¹⁵ There are only ten regional EPA offices in the United States, so it may be physically impossible for an EPA agent or

108. See, e.g., Transcript of Record, *supra* note 15, at 368–69 (discussing a model designed specifically to evaluate nutrients in livestock areas).

109. See *id.* (discussing how models incorporate characteristics of the soil). The type of soil in an area is very important to a hydrologist's analysis because water flows differently in different types of soils. For example, based on the type of soil, water could turn into runoff, plants could absorb the water, or it could "infiltrate." *Id.* at 398–99.

110. See *id.* (discussing the data that goes into creating a model).

111. *Id.* at 403–05.

112. *Id.* at 403.

113. Transcript of Record, *supra* note 15, at 404–05. There may be more than one National Oceanic and Atmospheric Administration ("NOAA") weather station close to a site. A hydrologist may run a "sensitivity" study where he or she places all of the same information in the model and only varies the weather station to see if the results of the study are the same. This ensures the accuracy of the study. If another station in a different direction produces the same results, then the station used is accurate. If not, then that is something for the hydrologist to consider when assessing the accuracy of the model. *Id.* at 405; see NOAA Satellite & Info. Serv., Locate Weather Observation Station Record, http://www.ncdc.noaa.gov/oa/climate/station_locator.html (last visited Jan. 23, 2010) (providing the weather service often used by hydrologists to find a weather station, obtain weather history, and find information about a given area).

114. See *supra* text accompanying notes 99–110 (explaining the accuracy of computer models and noting positive reviews of the models).

115. Telephone Interview with Stephen Pollard, *supra* note 15 (explaining that the EPA cannot always predict the weather, and therefore, it does not always know when it will rain, which would allow scientists to get a clear sample of discharge); see EPA, Regional Offices, <http://www.epa.gov/epahome/regions.htm> (last visited Jan. 23, 2010) [hereinafter EPA, Regional Offices] (providing a list and map of all regional EPA offices in the United States).

contractor to be present in an area that is about to have a discharge, especially if the discharge location is far from the regional EPA office.¹¹⁶ Also, though the EPA may delegate its authority to state agencies to handle CWA matters,¹¹⁷ its relations with those agencies are not always “free-flowing.”¹¹⁸ The EPA and the state agencies to which it delegates its CWA-enforcement authority are separate entities, and information regarding operations does not automatically pass from one agency to the other.¹¹⁹ If the EPA cannot rely on a different agency to handle its cases and cannot physically visit a point source it suspects is polluting at a time when sampling would be beneficial, then computer modeling is an attractive alternative to sampling.

IV. APPLYING *WATERKEEPER ALLIANCE, INC. v. EPA*

*Waterkeeper Alliance, Inc. v. EPA*¹²⁰ involved a group of farmers who sued the EPA in the Second Circuit over a CAFO rule that required NPDES permits for facilities that could potentially discharge pollutants into navigable waters.¹²¹ The farmers argued that by requiring all CAFOs to either apply for an NPDES permit or show that there was zero discharge from their operation, the EPA had “exceeded its statutory jurisdiction.”¹²² According to the Act’s text, the EPA is allowed to regulate “only the discharge of pollutants.”¹²³ The Act articulates that “[e]xcept as in compliance with this section and sections . . . of this title, the discharge of any pollutant by any person shall be unlawful.”¹²⁴ This point is further

116. See EPA, Regional Offices, *supra* note 115 (showing the broad range of geographic areas that each regional office must cover).

117. See Iowa Dep’t of Natural Res., NPDES Permits, <http://www.iowadnr.gov/water/npdes/index.html> (last visited Jan. 25, 2010) (explaining that the EPA delegated authority to the Iowa Department of Natural Resources in Iowa); Nat’l Sci. & Tech. Ctr., Water Quality Law Summary: California, <http://www.blm.gov/nstc/WaterLaws/california2.html> (last visited Jan. 25, 2010) (explaining that California’s State Water Resource Control Board and its Regional Water Quality Control Boards handle NPDES permits in the State of California); Nat’l Sci. & Tech. Ctr., Water Quality Law Summary: Montana, <http://www.blm.gov/nstc/WaterLaws/montana2.html> (last visited Jan. 25, 2010) (explaining that the Montana Department of Environmental Quality Water Protection Bureau handles NPDES permits in the State of Montana); Wash. State Dep’t of Ecology, National Pollutant Discharge Elimination System (NPDES) Permits, <http://www.ecy.wa.gov/programs/swfa/npdespermit.html> (last visited Jan. 25, 2010) (explaining that the EPA delegated its power to issue NPDES violations to the Washington State Department of Ecology in the State of Washington).

118. Telephone Interview with Stephen Pollard, *supra* note 15 (explaining that though the EPA has delegated some of its authority to regulate the CWA in Iowa, the offices are two separate entities and information is not always concurrent).

119. *Id.*

120. *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 490 (2d Cir. 2005).

121. *Id.* at 504.

122. *Id.*

123. *Id.*

124. 33 U.S.C. § 1311(a) (2006).

emphasized in the Act's other sections because they only discuss pollutant-discharge regulation and do not mention ways to prevent pollution.¹²⁵

The *Waterkeeper* court concluded that “unless there is a ‘discharge of any pollutant,’ there is no violation of the Act” and therefore, “point sources are . . . neither statutorily obligated to comply with EPA regulations for point sources discharges, nor are they statutorily obligated to seek or obtain an NPDES permit.”¹²⁶ Consequently, unless there is “an actual addition of any pollutant to navigable waters” from a point source, “there is no point source discharge, no statutory violation, no statutory obligation of point sources to comply with EPA regulations for point source discharges, and no statutory obligation of point sources to seek or obtain an NPDES permit.”¹²⁷ The EPA changed its CAFO rule to reflect the *Waterkeeper* decision as of October 31, 2008 to “require[] that an owner or operator of a CAFO that actually discharges to streams, lakes, and other waters . . . apply for a permit under the . . . Act.”¹²⁸

Though *Waterkeeper* was not about computer modeling, it did set guidelines for this issue because it emphasized that Congress intended the CWA to regulate actual discharge.¹²⁹ If the EPA can only regulate actual discharge, it must prove actual discharge occurred to issue a CWA violation. Therefore, when the EPA uses computer modeling to prove CWA violations, the *Waterkeeper* issue becomes whether computer modeling produces evidence sufficient to prove actual discharge. Since computer modeling produces results that are not always accurate due to some non-specific data and human judgment and lacks the ability to produce tangible evidence,¹³⁰ computer modeling does not produce evidence of actual discharge. Additionally, computer modeling is inherently incapable of producing evidence of actual discharge because it is a simulation of reality,¹³¹ and simulations are not real or “actual.” Therefore, when the EPA uses computer

125. See *id.* § 1311(c) (“Effluent limitations . . . shall be applied to all point sources of discharge of pollutants.”); *id.* § 1342(a)(1) (giving NPDES authorities the option to “issue a permit for the discharge of any pollutant, or combination of pollutants”); *id.* § 1342(b) (giving states the option to grant permits for “discharges into navigable waters”).

126. *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 504 (2d Cir. 2005); see 33 U.S.C. § 1362(12) (defining the “discharge of a pollutant to be any addition of any pollutant to navigable waters from any point source” or “any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft”).

127. *Waterkeeper*, 399 F.3d at 505.

128. Press Release, EPA, New Requirements for Controlling Manure, Wastewater from Large Animal Feeding Operations (Oct. 31, 2008), available at <http://yosemite.epa.gov/opa/admpress.nsf/dc57b08b5acd42bc852573c90044a9c4/eafce2ca2b2e2e2dea852574f300607fef?OpenDocument>.

129. *Waterkeeper*, 399 F.3d at 505.

130. See *supra* Part III.B (discussing reasons the EPA prefers to use computer modeling).

131. See *supra* text accompanying note 17 (defining computer models and explaining that they are simulations of reality).

modeling to enforce the CWA, it fails to meet the actual-discharge burden of proof.

V. PROBLEMS WITH COMPUTER MODELING

Several problems occur when the EPA uses computer modeling to enforce the CWA. The Act requires the EPA or authorized agency to show five components when proving a violation under the Act.¹³² The EPA must show that “a defendant (1) discharged (2) a pollutant (3) into navigable waters (4) from a point source (5) and the discharge was not authorized” by another provision in the Act.¹³³ The ultimate problem with the EPA’s use of computer modeling to enforce the Act’s provisions is that it is impossible for computer modeling to prove a discharge without information that is completely site specific¹³⁴—information that might be impossible to obtain since data required for modeling is based on historical conditions and mathematical equations, not data obtained from an identical scene.¹³⁵ As a result, computer models rarely produce tangible evidence.¹³⁶ Modeling is merely a simulation of circumstances, and therefore, produces predictions and estimates, but never verifies pollution.¹³⁷ An EPA office may use computer modeling as its sole source of enforcement, without ever obtaining any evidence to support the model’s conclusion—namely an actual sample of the alleged pollution.¹³⁸ If a computer model generates results indicating that a feedlot lacking proper authorization has discharged pollutants into a local river sixteen times, then the EPA may fine that feedlot sixteen times without ever obtaining tangible evidence to support its conclusions.

There are several other problems with computer modeling that scientists should correct before the EPA uses computer models to issue CWA violations. First, as this Note explains above, the models are often inaccurate.¹³⁹ The progression of science is impressive when considering the history of and improvements made in computer modeling, but that progression does not make computer modeling perfect or appropriate to issue CWA violations, because there is no computer model that guarantees one-hundred-percent accurate results. If the models can be so unreliable as

132. Ginsberg & Merrick, *supra* note 72, at 225.

133. *Id.*

134. *See* Doe & Harmon, *supra* note 17, at 7 (noting that computer modeling is merely a simulation of reality).

135. *See supra* notes 92–98 and accompanying text (describing the parameters used in computer models and how those factors may be obtained).

136. *Id.*

137. *Id.*

138. Telephone Interview with Stephen Pollard, *supra* note 15.

139. *See supra* text accompanying notes 105–06 (describing potential imperfections in computer modeling).

to generate results that may be off by fifty percent,¹⁴⁰ then it is possible that the EPA could fine CAFOs and other facilities for violations they never committed. Although studies have shown that computer modeling has become more accurate as technology advances,¹⁴¹ they have not shown that computer modeling is accurate enough to issue CWA violations, or that computer modeling has the ability to prove actual discharge as *Waterkeeper* requires.¹⁴²

One accuracy problem could be linked to the fact that models use parameter information that is not completely site specific—the information could be close, but is likely inexact.¹⁴³ Parameter information is the closest information a hydrologist can find to that site.¹⁴⁴ Computer models use data that has been empirically observed for conditions and landscapes similar to the at-issue site, but they usually do not use data that was generated under all of the same conditions.¹⁴⁵ Since the numbers plugged into equations are based on general data for parameters like those needed to complete the computer modeling and were not generated from a challenged site under conditions specific to the circumstances at hand, accuracy may be difficult to obtain. Researchers have noted this issue as the SWAT model's general weakness, since it does not always generate accurate results taking parameters that were “not directly measured” for the equations.¹⁴⁶ For example, some of the equations that the SWAT model uses are determined empirically based on other data, so those components are not based on the specific land area or situation at hand.¹⁴⁷ Another accuracy problem exists if the models are used over a wide landscape, because the results may be tainted by “[c]omputational difficulties . . . due to variations in scale, grid networks, and flows that complicate the mathematical approximations” used

140. SCI. APPLICATIONS INT'L CORP., *supra* note 105, at 10 (presenting information, for the EPA's Region 7, pertaining to the manure and soil runoff at a feedlot); *see* Bosch et al., *supra* note 105, at 1505 (concluding that SWAT generated results that were typically within twenty percent of water balances observed); *see also* Transcript of Record, *supra* note 15, at 449 (noting that the models may be inaccurate by up to forty-nine percent).

141. *See supra* notes 100–03 and accompanying text (describing the accuracy and precision of computer-modeling programs, such as APEX and SWAT).

142. *See supra* text accompanying note 129 (describing *Waterkeeper's* “actual discharge” requirement). As hydrologist Sandra Doty testified in an enforcement case, “these models don't evaluate [on a] small scale. It's averaging. And when you start to talk about averaging over larger areas, . . . you start to talk about error associated with [the model] because you can't predict what is happening at every particular spot within [the] watershed.” Transcript of Record, *supra* note 15, at 449.

143. *Id.* at 471.

144. *Id.*

145. *Id.*

146. Benaman et al., *supra* note 95, at 371.

147. *Id.* (noting that the curve-number equation and MUSLE are not ideal equations for obtaining the most accurate results).

in the model.¹⁴⁸ Other limitations of the model include “simulation of snowmelt, evapotranspiration, snowmelt erosion, floodplain erosion, and sediment-transport routines.”¹⁴⁹

Computer modeling can be used effectively to plan a NPDES permit or to estimate the amount of pollutants a facility may discharge into a navigable water source, but it is a simulation, not reality. Since these models are used to identify a CWA violation, it is possible that CAFO facilities are fined without any tangible evidence of pollutant discharge. Therefore, while these computer models can establish whether a CAFO has the ability to eventually discharge pollutants, and the quantity and frequency of that discharge, they do not provide proof that actual discharge occurred.¹⁵⁰ Ultimately, no computer or any other model can ever “completely and accurately describe the complexities and inter-relationships in nature.”¹⁵¹

VI. POSSIBILITIES AND IMPLICATIONS FOR CHANGING ENFORCEMENT

There are several problems with computer modeling as a CWA-enforcement measure, such as its inability to prove pollutant discharges and its accuracy problems.¹⁵² The EPA should avoid using computer models to issue CWA violations, and instead consider three alternatives: (1) direct sampling, (2) delegating more power to the states, and (3) combining sampling and computer modeling.

A. DIRECT SAMPLING

Instead of using computer modeling to issue CWA violations, the EPA could rely on direct sampling, similar to that which the Iowa Department of Natural Resources (“IDNR”) uses. The IDNR handles a variety of CWA violations and never uses computer modeling to do so.¹⁵³ After hearing about a potential CWA violation, the IDNR sends one or two agents to the challenged site to look for a point source.¹⁵⁴ If they can find a source, they then take a sample using a small tube from their field-test kit, which they take to most sites.¹⁵⁵ Their kit is relatively small, containing at least two tubes—one for the alleged polluted waste sample and one for the clean water sample—and a solution that detects the presence of ammonia upon

148. Doe & Harmon, *supra* note 17, at 8.

149. Benaman et al., *supra* note 95, at 372.

150. *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 505 (2d Cir. 2005) (discussing an EPA rule that imposed obligations upon CAFO facilities with the potential for pollutant discharge, even where no evidence of pollutant discharge existed).

151. Doe & Harmon, *supra* note 17, at 7.

152. *See supra* Part V (explaining problems with computer modeling).

153. Telephone Interview with Jim Sievers, Env'tl. Specialist, Sr., Iowa Dep't of Natural Res. (Jan. 15, 2009).

154. *Id.*

155. *Id.* The kit is small and easy to take to any site. *Id.*

adding it to a polluted sample.¹⁵⁶ The IDNR agents add a few drops of the solution to the challenged sample, and if it turns yellow–orange in color, that means that ammonia is present (which indicates that the sample probably contains runoff–animal–organic matter or pollutant(s)).¹⁵⁷ Next, they match the sample’s color to a shade on a color wheel to determine the ammonia level present in the sample.¹⁵⁸ The agents then send the sample to a lab to determine the lab values of ammonia, bacteria, and biochemical oxygen demand (“BOD”).¹⁵⁹ If there is a significant level of each, then the evidence suggests the presence of pollutants in the water and the IDNR uses that evidence to issue a violation.¹⁶⁰ The IDNR also typically takes photos of challenged sites because the water color or visible matter in the water is indicative of whether the water contains a high degree of pollutants.¹⁶¹

Quite often, EPA agents seeking to enforce the Act do not take samples, and the EPA’s standard-operating procedures are often different than the procedures the IDNR uses.¹⁶² Some EPA sampling procedures are more complicated than the IDNR’s, depending on the regional office.¹⁶³ For example, the EPA’s Region 7 office requires a more-equipped field kit and that more samples be taken, making sampling more difficult than it is for the IDNR.¹⁶⁴ Sampling in the Region 7 office tends to involve sampling for ammonia, dissolved oxygen, pH, total nitrogen, and total phosphorus.¹⁶⁵ The IDNR takes samples using just one tube of alleged polluted water and typically tests only for ammonia.¹⁶⁶ With the EPA’s more complicated procedures, its workers often do not even take a field kit with them.¹⁶⁷ Often, this means that there is not a sample to validate the model.¹⁶⁸

Therefore, the EPA might argue that this possibility is impracticable because sampling might require EPA agents to bring potentially large field

156. *Id.*; see *infra* note 172 (describing how an IDNR worker always takes equipment with him, no matter where he is going).

157. *Id.*

158. Telephone Interview with Jim Sievers, *supra* note 153.

159. *Id.* BOD detects the level of oxygen in a sample. *Id.* When there is a heavy concentration of organic matter in water, it often removes the oxygen in the water, leaving low levels of oxygen. *Id.*

160. *Id.*

161. *Id.*

162. See Telephone Interview with Stephen Pollard, *supra* note 15 (explaining that there is a standard EPA procedure for sampling that involves testing for several different chemicals, requiring more equipment than the IDNR uses).

163. *Id.*

164. *Id.* See generally BRUCE LITTELL, EPA REGION 7 OFFICE, STANDARD OPERATING PROCEDURE NO. 2334.3B, WASTEWATER SAMPLE COLLECTION (2002) (providing the standard-operating procedure for sampling for the EPA’s Region 7 office).

165. Telephone Interview with Stephen Pollard, *supra* note 15.

166. Telephone Interview with Jim Sievers, *supra* note 153.

167. Transcript of Record, *supra* note 15, at 290.

168. *Id.*

kits to sites and take samples to prove pollution that computer models could have shown. Additionally, sampling is easier to do after rainfall,¹⁶⁹ and the organization could argue that a court should not expect its workers to camp out on a site when a storm is about to occur in order to obtain a sample of the resulting runoff. The EPA may need to send samples to a lab several hundred miles away to confirm or deny whether a chemical is present in the samples, while the IDNR often has labs geographically closer.¹⁷⁰ Because sampling is important to obtaining evidence of actual discharge, the EPA could modify some of its existing complicated procedures to make regular sampling easier to implement and less of a burden. For example, it could test for fewer chemicals or take only one sample.

B. DELEGATING MORE POWER TO STATES

It is probably not feasible for the EPA to independently conduct sampling as an alternative to computer modeling when enforcing the CWA. The EPA could delegate more of its enforcement powers to the states.¹⁷¹ A state agency could better enforce the policy or conduct more of the sampling legwork.¹⁷² However, the EPA faces several possible implications and consequences when it delegates or attempts to delegate more power to state agencies.¹⁷³ First, not every state may have the resources and agents to take on more enforcement or to conduct all necessary testing. Therefore, even if the EPA wanted to delegate more power, it may not be able to give the states as many cases as it would like because the states lack resources and the ability to regulate.

Second, if the EPA wanted to have a state agent do work on an EPA case (for example, if the EPA had an IDNR agent collect samples, but maintained its position handling a case and issuing violations), then agencies would be working concurrently. Although this occurs occasionally,¹⁷⁴ working

169. Telephone Interview with Stephen Pollard, *supra* note 15.

170. *Id.*

171. See *supra* text accompanying notes 45–49 (discussing the EPA’s ability to delegate some of its regulatory power to the states).

172. Transcript of Record, *supra* note 15, at 924 (IDNR worker explaining that he has field-sampling equipment with him each time he goes out in his vehicle and describing the kit’s components: “an ammonia test kit for high range and low range, dissolved oxygen test kit, a pH meter, the calibration liquids for calibrating the pH meter,” and sample bottles that can be submitted to a laboratory for pollution analysis).

173. Giving states more authority to regulate an NPDES program would not restrict the EPA’s ability to step into any case, since the EPA’s power to enforce the provisions of the Act remains, “[e]ven in those states where [the] EPA has delegated authority to implement the NPDES program.” Ginsberg & Merrick, *supra* note 72, at 223; see also 33 U.S.C. § 1342(i) (2006) (“Federal enforcement not limited. Nothing in this section shall be construed to limit the authority of the Administrator to take action pursuant to section 309 of this Act . . .”). However, if the EPA does delegate its authority to a state, it is required to notify the state of its involvement in a particular case. *Id.* § 1319(a).

174. Telephone Interview with Stephen Pollard, *supra* note 15.

together on a regular basis would raise the following issues: (1) which agency would receive funding to handle certain cases, (2) which agency would actually issue a violation, and (3) whether the EPA is abusing its authority by asking state agents to also work as EPA agents.

Third, the EPA would probably end up issuing fewer violations. When the IDNR or another state agency fines a facility, it does so based on results of water sampling, meaning that they fine a site if the water sample tests positive for pollutants.¹⁷⁵ However, when the EPA fines a facility based on the results of the computer modeling, the EPA fines the site for each time the models say that the site discharged pollutants.¹⁷⁶ Since the computer models estimate the amount and frequency that a facility polluted, the EPA can fine a facility for every violation rather than issuing a single violation based on one-time scientific sampling—resulting in a stark difference in the amount of money the EPA and IDNR each fine.¹⁷⁷ However, this is not necessarily a negative change. In cases where computer modeling is inaccurate, the EPA fines operations for pollution that may not have happened. Additionally, when using computer modeling the EPA again issues multiple fines without tangible evidence. Therefore, if the EPA issues fewer fines, it decreases the probability of issuing fines for pollution when no concrete evidence exists. If the EPA instead uses sampling to issue a fine, it will only be able to issue one fine, but it will be certain that an operation is guilty of water pollution.

C. USING SAMPLING IN CONJUNCTION WITH COMPUTER MODELING

Another alternative to using computer modeling as a sole enforcement method is to use it in conjunction with sampling. This would validate computer modeling, which would increase the chances of computer-modeling accuracy.¹⁷⁸ If the EPA used computer modeling in conjunction with sampling, then the EPA could claim its validity for reasons other than reasonableness or a comparison with historical data. In this situation, the EPA could use modeling as a tentative guide in issuing violations. However, because modeling is still fraught with many of the same difficulties as when the EPA uses modeling as its sole evidence source, this suggestion may not defeat the actual-discharge issue. Because computer modeling still has the possibility of being wrong in regard to the frequency that a facility discharged pollution, it is important that computer modeling not be the

175. *Id.*

176. *Id.*

177. The courts apply a strict liability standard to violations under the Act. Ginsberg & Merrick, *supra* note 72, at 225. Therefore, “good faith or lack of knowledge is irrelevant to establishing civil liability.” *Id.*; see Kelly v. EPA, 203 F.3d 519, 521–23 (7th Cir. 2000) (providing an example of strict liability enforcement under the Act).

178. See *supra* note 172 and accompanying text (providing the testimony of an IDNR worker who always has sampling equipment in his vehicle).

ultimate evidence source, but merely support other available evidence. Using sampling in conjunction with modeling would be an improvement from the process the EPA uses today, but it still does not solve the problem of proving every discharge.

VII. CONCLUSION

The CWA gives the EPA authority to regulate actual discharge of pollutants. The *Waterkeeper* case and the recent change in the EPA's CAFO regulations emphasize this point. Currently, the EPA uses computer modeling to issue CWA violations. The computer models simulate landscapes and general conditions for challenged sites, and estimate the amount and frequency that a facility allegedly discharged pollutants into navigable waters. Although computer models may be accurate, they do not prove that actual discharge occurred because they are mere attempts to simulate reality. Therefore, by using computer modeling to issue CWA violations, the EPA fails to meet its burden of proof of showing actual discharge.

Although computer modeling is helpful in other CWA sectors (planning NPDES permits, for example) and in conservation, hydrology, and sediment research,¹⁷⁹ it currently has no place in CWA enforcement. The EPA should change its policy to require its agents to take water samples of allegedly polluted areas to ensure pollution did, in fact, occur. Until the EPA changes its enforcement policies, it will fail to meet its burden of proof by failing to prove that actual discharge occurred in navigable waters.

179. See *supra* Part III.B (discussing computer-modeling benefits).