NATURAL RESOURCES JOURNAL

Volume 51
Issue 1 *Spring*

Spring 2011

Methane as a Greenhouse Gas: Why the EPA Should Regulate Emissions from Animal Feeding Operations and Concentrated Animal Feeding Operations under the Clean Air Act

John Verheul

JOHN VERHEUL*

Methane as a Greenhouse Gas: Why the EPA Should Regulate Emissions from Animal Feeding Operations and Concentrated Animal Feeding Operations Under the Clean Air Act

ABSTRACT

Animal agriculture has been emitting an increasing amount of methane each year. This greenhouse gas is roughly 21 times as potent as carbon dioxide (CO_2) yet has an atmospheric lifetime that is less than one-fifth that of CO_2. As a result, even relatively small decreases in methane emissions will have a faster, more profound effect on climate change than CO_2. In addition to regulating greenhouse gas emissions, the Environmental Protection Agency (EPA) has the authority to treat Animal Feeding Operations (AFO) and Concentrated Animal Feeding Operations (CAFO) as industrial polluters under the Clean Air Act (CAA). This article examines how and why the EPA should move to immediately regulate methane emissions from AFOs and CAFOs under the CAA, especially given the lack of congressional leadership in this area. Solutions exist for the industry to lower methane emissions. In addition to the short- and long-term environmental benefits, the EPA's regulation could also serve as both a model for other industries and an impetus for Congress to act in the area of climate change.

I. INTRODUCTION

Over the past decade, climate change[1] has become more and more entwined in our public conscience. It is hard to pick up a major newspaper or news magazine without seeing references to the concept, while movies such as Al Gore's *An Inconvenient Truth* further educate the pub-

* John Verheul is a 2011 graduate of the University of New Mexico School of Law, with a Certificate in Natural Resources and Environmental Law, and received the Albert E. Utton award for excellence in natural resources law. He would like to thank UNM Law Professor Reed Benson for his guidance and feedback throughout the process of writing this article.

1. "Climate change refers to any significant change in measures of climate (such as temperature, precipitation or wind) lasting for an extended period (decades or longer)." *See, e.g.*, *Climate Change–Basic Information*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/basicinfo.html (last updated Dec. 17, 2010).

lic on its causes and effects. Many people are familiar with the theory that carbon emissions from human activity over the last century are the primary cause.[2] Most discussions focus on large-scale industrial pollution such as the burning of coal or on the carbon dioxide (CO_2) emitted from each and every internal combustion engine on the planet.[3] Human activity produces far more CO_2 than all other greenhouse gases combined, but the fact remains that many other gases are far more effective at trapping heat.[4]

An often overlooked greenhouse gas many times more potent than CO_2 is methane,[5] which is responsible for nearly as much climate change as all other non-CO_2 greenhouse gases put together.[6] Methane concentrations in the atmosphere have increased much more than CO_2 concentrations over the last century.[7] In 2008, methane emissions in the United States totaled 737.4 million metric tons carbon dioxide equivalent (MMTCDE),[8] or 10.5 percent of total greenhouse gas emissions.[9] While various sources are responsible for the methane released into the atmosphere, this article focuses on Animal Feeding Operations (AFO) and

---

2. *Climate Change–Science–State of Knowledge*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/science/stateofknowledge.html (last updated Aug. 19, 2010).

3. *Climate Change–Greenhouse Gas Emissions*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/emissions/index.html (last updated Oct. 19, 2010).

4. *Climate Change–Climate Economics–Non-CO_2 Mitigation*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/economics/mitigation.html (last updated Sep. 10, 2009).

5. *Climate Change–Methane–Sources & Emissions*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/methane/sources.html (last updated June 22, 2010) [hereinafter U.S. ENVTL. PROT. AGENCY, *Methane*].

6. James E. Hansen & Makiko Sato, *Trends of Measured Climate Forcing Agents*, 98 PROCEEDINGS OF THE NAT'L ACAD. OF SCI. 14,778, 14,778–83 (Dec. 18, 2001). Estimated climate forcing of methane from 1850 to 2000 is 0.7 watts/square meter (W/m^2), while estimated forcing of chlorofluorocarbons (CFC), tropospheric ozone, and nitrous oxide combined is 0.9 W/m^2.

7. *Emissions of Greenhouse Gases Report*, U.S. ENERGY INFO. ADMIN., http://www.eia.doe.gov/oiaf/1605/ggrpt (last visited Jan. 4, 2010). Atmospheric CO_2 concentrations rose from 278 parts per million (ppm) in 1750 to 365 ppm in 1998, a 31 percent increase. Atmospheric concentrations of methane rose by 149 percent in that time period, from .700 ppm to 1.745 ppm.

8. For an "apples to apples" comparison of various greenhouse gases, it is common practice to refer to the climate change impact of any greenhouse gas as compared with the most common of them, CO_2. The International Carbon Bank & Exchange website allows users to calculate MMTCDE. *ClimateSafe Standard*, INT'L CARBON BANK & EXCH., http://www.icbe.com/climatesafe/standards.asp (last visited Jan. 4, 2010).

9. U.S. ENERGY INFO. ADMIN., EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2008 1 (2008) [hereinafter USEIA 2008], *available at* http://www.eia.doe.gov/oiaf/1605/ggrpt/pdf/0573(2008).pdf.

Concentrated Animal Feeding Operations (CAFO),[10] which account for a significant percentage of U.S. methane emissions.

Since 1970, the Clean Air Act (CAA) has been the primary tool of the U.S. government for regulating harmful airborne pollutants.[11] This regulation is carried out by the Environmental Protection Agency (EPA).[12] At a general level, the EPA classifies a specific substance as a pollutant and is then able to regulate its release into the atmosphere. To be effective, science and government should stay in step with each other; as more scientific evidence is presented as to the harmful effects of a substance, the EPA can then classify the substance as a pollutant and regulate its emissions.[13]

Given the mounting scientific evidence of the reality of climate change,[14] the impact of methane as a greenhouse gas,[15] and the challenges involved in passing climate change legislation in the United States,[16] the time is now for the EPA to move quickly to regulate emissions from animal agriculture such as AFOs and CAFOs. Such an approach would be consistent with established regulation of AFO and CAFO pollution in the United States through the Clean Water Act (CWA).[17]

This article first provides an overview of the animal agriculture industry and the current state of environmental regulation of AFOs and CAFOs. Next, it explains the relative importance of greenhouse gases in general, methane in particular, and the impacts of climate change. Third, it discusses the process through which the EPA regulates through the CAA. Finally, it presents how and why the EPA should regulate methane emissions from AFOs and CAFOs, including potential impacts of this regulation on industry as well as steps that can be taken to minimize negative impacts.

---

10. *What Is a CAFO?*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/region7/water/cafo/index.htm (last updated Nov. 30, 2010).

11. Air Pollution Prevention and Control Act, 42 U.S.C. §§ 7401–7671q (2006).

12. *Clean Air Act*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/air/caa/ (last updated Sept. 22, 2010).

13. 42 U.S.C. §§ 7414–7415 (2006).

14. *Climate Change–Basic Information*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/basicinfo.html (last updated Dec. 17, 2010).

15. U.S. ENVTL. PROT. AGENCY, *Methane*, *supra* note 5.

16. *See* discussion *infra* Parts V.E, V.F.

17. 33 U.S.C. § 1362(14) (2006) specifically gives the EPA authority over those types of operations. The CWA regulates CAFOs under its National Pollutant Discharge Elimination System. *See* 33 U.S.C. § 1342(a) (2006).

II. OVERVIEW OF ANIMAL AGRICULTURE

A. Animal Agriculture in the United States

In 1900, 41 percent of the U.S. workforce was employed by the agriculture industry.[18] In 1930, agriculture contributed 7.7 percent of the nation's gross domestic product (GDP).[19] By 2000, the workforce employed in the agriculture industry had shrunk to only 1.9 percent, while in 2002, the industry represented only 0.7 percent of the GDP.[20] The prevalent form of animal agriculture 40 years ago was the family farm, whereas today most livestock production has shifted to factory farming.[21] Factory farms first appeared in the poultry industry in the 1940s.[22] Today, fewer farms exist yet production overall is greater from this lower number of farms.[23] From 1900 to 2002, the number of farms decreased by 63 percent while the average farm size grew by 67 percent.[24]

The result is large operations with higher concentrations of animals, focused more on production than ever before.[25] For example, "[t]he poultry industry is 98 percent vertically integrated, which means that 98 percent of all poultry produced is bred, owned, butchered, and marketed by giant corporations such as Tyson, ConAgra, [and] Perdue . . . ."[26] "Vertical integration" in animal agriculture refers to growers of animals managing those animals, which are supplied to them by a corporation, along with feed, medications, and veterinary care.[27] In 1998, more than 60 percent of the federally inspected hogs sent to slaughter were

---

18. CAROLYN DIMITRI ET AL., U.S. DEP'T OF AGRIC., THE 20TH CENTURY TRANSFORMATION OF U.S. AGRICULTURE AND FARM POLICY (Elec. Info. Bull. No. 3, June 2005), *available at* http://www.ers.usda.gov/publications/EIB3/eib3.pdf.

19. *Id.*

20. *Id.*

21. *See* ROBBIN MARKS & NATURAL RESOURCES DEF. COUNCIL, THE CLEAN WATER NETWORK, CESSPOOLS OF SHAME: HOW FACTORY FARM LAGOONS AND SPRAYFIELDS THREATEN ENVIRONMENTAL AND PUBLIC HEALTH (2001), *available at* http://www.nrdc.org/water/pollution/cesspools/cesspools.pdf.

22. JIM MASON & PETER SINGER, ANIMAL FACTORIES: THE MASS PRODUCTION OF ANIMALS FOR FOOD AND HOW IT AFFECTS THE LIVES OF CONSUMERS, FARMERS, AND THE ANIMALS THEMSELVES (1980).

23. MARKS & NATURAL RESOURCES DEF. COUNCIL, *supra* note 21.

24. DIMITRI ET AL., *supra* note 18.

25. MARKS & NATURAL RESOURCES DEF. COUNCIL, *supra* note 21.

26. Poultry Growers: Canaries in the Coal Mine, FARM AID NEWS & VIEWS (July 1996) (Institute for Agriculture and Trade Policy for Farm Aid, Minneapolis, Minn.), http://www.ibiblio.org/london/agriculture/forums/sustainable-agriculture/msg00358.html.

27. Susan M. Brehm, Comment, *From Red Barn to Facility: Changing Environmental Liability to Fit the Changing Structure of Livestock Production*, 93 CAL. L. REV. 797, 805 (2005). This is different than traditional, family farming operations where the farmer retains greater control over how the animals are grown and managed.

processed by only four packing houses,[28] while in the beef cattle industry, the four largest beef packers accounted for at least 71 percent of output in 1992 and as much as 87 percent by 1998.[29] Vertical integration has become the preferred model for large agribusiness.[30]

B. Animal Feeding Operations

The EPA defines Animal Feeding Operations in the CWA implementing rules as "a lot or facility . . . where animals . . . have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period."[31] Concentrated Animal Feeding Operations are distinguished by their size; an AFO is a CAFO if it can be classified as a "Medium CAFO" or "Large CAFO."[32] For example, a swine AFO is a "Medium CAFO" if it has "750 to 2,499 swine each weighing 55 pounds or more," or "3,000 to 9,999 swine each weighing less than 55 pounds."[33] An AFO would be a "Large CAFO" if it has more than 2,500 swine each weighing 55 or more pounds, or more than 10,000 swine weighing less than 55 pounds.[34] Size and number ranges differ for each type of animal.[35] In addition, Medium CAFOs, to be classified as such, must also discharge pollutants into the waters of the United States, either through a manmade device or directly.[36] The EPA further describes AFOs as agricultural enterprises that "congregate animals, feed, manure and urine, dead animals, and production operations on a small land area."[37] Due to their profitability, AFOs and CAFOs have increasingly been imposed on producers by the vertically integrated entities that now dominate animal agriculture.[38]

---

28. Jean Anne Casey & Colleen Hobbs, *Lean Times on the Hog Farm*, N.Y. TIMES, Jan. 29, 1999, at A19. "Packing house" is the industry term for the facility where animals are slaughtered and processed. "Slaughterhouse" is perhaps the more descriptive term.

29. James M. MacDonald & Michael Ollinger, *U.S. Meat Slaughter Consolidating Rapidly*, FOOD REVIEW, May–August 1997, at 22, *available at* http://www.ers.usda.gov/publications/foodreview/aug1997/may97f.pdf.

30. Brehm, *supra* note 27, at 803.

31. 40 C.F.R. § 122.23 (b)(1) (2010).

32. *Id.* at (b)(2).

33. *Id.* at (b)(6).

34. *Id.* at (b)(4).

35. *Id.* at (b)(4), (b)(6).

36. *Id.* at (b)(6). *See also*, *Questions & Answers on CAFOs*, N.M. ENV'T DEP'T, http://www.nmenv.state.nm.us/swqb/CAFO/ (last visited Jan. 28, 2011).

37. *Animal Feeding Operations–Frequently Asked Questions*, U.S. ENVTL. PROT. AGENCY, http://cfpub.epa.gov/npdes/faqs.cfm?program_id=7 (last updated Oct. 18, 2007).

38. Brehm, *supra* note 27, at 808–809.

C. Methane Emissions from Animal Agriculture in the United States

Since 2003, animal agriculture in the United States has released more than 200 MMTCDE of methane into the atmosphere each year.[39] In 2008, the number was 213.1 MMTCDE, representing 3.02 percent of all U.S. greenhouse gas emissions, and *95 percent* of all U.S. agricultural methane emissions.[40] For an industry representing only 0.7 percent of the GDP and 1.9 percent of the workforce, animal agriculture as practiced today clearly contributes more than its share of greenhouse gas emissions. Perhaps more striking is that these emissions rose by 11.7 percent since 1990 and show no signs of slowing.[41]

A question that often arises is why are methane emissions from this industry growing disproportionately fast? Are we eating that much more meat as a country?[42] The answer lies partially in a key distinction between AFOs and more traditional animal agriculture practices: AFOs are defined in part by the absence of any sort of crops or vegetation being grown on them.[43] In traditional livestock operations, in which animals were kept on farms that also engaged in crop growing, animal waste was used as a natural fertilizer for these crops.[44] In this regard, traditional animal agriculture was part of agriculture as a whole and was self-sustaining to the extent that the animal operations created the fertilizer for the crops while the crops, in part, provided feed for the animals.[45] AFOs, in contrast, have no use for the animal waste that is produced. Typically, animals are housed on slatted floors, which allow waste to fall to a holding area from where it is eventually transported to a waste "lagoon."[46] Water (a resource not always in abundance) is used to flush the animal waste from the buildings to the lagoons, essentially to make transporting the waste more convenient.[47] Because AFOs have much less land area than traditional farms—often due to the lack of crops—and do not use the animal waste as fertilizer, much less land is available to distribute the waste with not enough land to absorb the

39. USEIA 2008, *supra* note 9, at 31.
40. *Id.* at 1, 31.
41. *Id.* at 31.
42. The answer is yes. Not only does our population continue to grow, but per capita meat consumption in the United States increased 13 percent from 1990–2007 and a whopping 35 percent from 1950–2007. *See Farm Animal Statistics: Meat Consumption*, THE HUMANE SOC'Y OF THE U.S., http://www.humanesociety.org/news/resources/research/stats_meat_consumption.html (last visited Jan. 25, 2010).
43. 40 C.F.R. § 122.23(b) (2010).
44. Brehm, *supra* note 27, at 809.
45. *Id.*
46. *Id.*
47. *Id.*

waste. As a result, the waste sits in the storage lagoons for extended periods of time.[48] Fermentation in these lagoons has generated most of the increase in animal agriculture methane emissions over the past two decades.[49] Since 1990, the methane emitted from lagoons has increased nearly 31 percent.[50] Such a significant increase in emissions, combined with a heightened awareness of the effects of greenhouse gas emissions, calls for a new look at how environmental statutes are applied to AFOs.

III. CURRENT ENVIRONMENTAL REGULATION OF AFOs

A. The CWA: CAFOs as Industrial Point Sources

The CWA is currently the primary federal environmental statute that is used to specifically regulate factory farming.[51] When it was originally enacted, in the form of the Federal Water Pollution Control Act Amendments of 1972, the CWA was intended for "the protection and maintenance of the chemical, physical and biological integrity of the nation's waters."[52] The CWA requires "point sources" of pollutant discharges to obtain permits for such discharge.[53] While it focuses on regulating industrial—and sewage treatment—point sources of pollutants, the CWA specifically includes CAFOs in its definition of an industrial point source: "The term 'point source' means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch . . . rolling stock, concentrated animal feeding operation . . . ."[54] What is of note is that the CWA treats CAFOs as industrial polluters, which they certainly are, at least in regard to the volume of their methane emissions.[55] This also distinguishes AFOs from CAFOs in that only CAFOs are treated as industrial polluters by the EPA and must obtain National Pollutant Discharge Elimination System (NPDES) permits under the CWA.[56] The NPDES permit program controls water pollution

48. *Id.*
49. USEIA 2008, *supra* note 9, at 31.
50. *Id.*
51. *See* Clean Water Act, 33 U.S.C. §§ 1251–1387 (1972 as amended).
52. CWA Statute, Regulations & Enforcement, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/compliance/civil/cwa/cwaenfstatreq.html (last updated May 18, 2010). The name was changed with amendments in 1977.
53. *See* 33 U.S.C. §§ 1311(a), 1342(a)(1) (2006).
54. 33 U.S.C. § 1362(14) (2006).
55. *See* discussion *supra* Part II.
56. NAT'L ACAD. OF SCI., AIR EMISSIONS FROM ANIMAL FEEDING OPERATIONS: CURRENT KNOWLEDGE, FUTURE NEEDS 34 (2003), *available at* http://www.4cleanair.org/nascaforeport.pdf.

by regulating point sources, such as pipes or manmade ditches, which discharge pollutants into waters of the United States.[57]

B. AFOs: Liability Under CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act[58] (CERCLA) is a federal law designed to fund the cleanup of "releases or threatened releases of hazardous substances that may endanger public health or the environment."[59] Industrial sources of hazardous emissions pay into a trust fund, which is used to clean up abandoned or uncontrolled hazardous waste sites.[60] CERCLA does not expressly impact CAFOs the way the CWA does; however, several courts have held that these operations are emitters of hazardous pollutants and are subject to CERCLA reporting requirements.

In 2003, in *City of Tulsa v. Tyson Foods, Inc.*, a city brought suit against several major poultry companies claiming the defendant's wastes had polluted several area lakes.[61] A U.S. Federal District Court held that the phosphates emitted by the poultry facilities were hazardous substances under CERCLA and that the city could assert cleanup cost contribution claims.[62]

In 2004, in *Sierra Club v. Seaboard Farms, Inc.* the U.S. Court of Appeals for the Tenth Circuit held that a farm complex as a whole—as opposed to each individual barn, lagoon, or land application—constituted a single facility for the purpose of CERCLA reporting requirements.[63] In doing so, the court found that the specific facility, a CAFO housing 25,000 swine, exceeded the "Reportable Quantity" (RQ) of 100 pounds of ammonia per day, subjecting it to immediate reporting requirements.[64]

C. The Courts: AFOs Under CERCLA, the CWA, and the CAA

Both cities as well as citizens groups have successfully applied pressure to animal agriculture through the courts. Even without an outright case decision, incremental holdings and consent decrees that come

---

57. *National Pollutant Discharge Elimination System*, U.S. ENVTL. PROT. AGENCY, http://cfpub.epa.gov/npdes/ (last updated Mar. 12, 2009).

58. 42 U.S.C. § 9601 (1980).

59. *Superfund–CERCLA Overview*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/superfund/policy/cercla.htm (last updated Oct. 1, 2010).

60. *Id.*

61. City of Tulsa v. Tyson Foods, Inc., 258 F. Supp. 2d 1263 (N.D. Okla. 2003).

62. *Id.*

63. Sierra Club v. Seaboard Farms, Inc., 387 F.3d 1167 (10th Cir. 2004).

64. *Id.* at 1168–69. *See also* Designation of Hazardous Substances, 40 C.F.R. § 302.4 (2010).

about through litigation are valuable for the purpose of making this industry responsible for its pollution.

In 2005, the City of Waco, Texas sued eight dairies and their owners and operators claiming causes of action under CERCLA, the CWA, and the Texas Solid Waste Disposal Act[65] (TSWDA). The U.S. District Court held that, among other things, phosphorus contained in cow manure and other materials generated from dairy operations could be deemed a "hazardous substance" under CERCLA and that the defendants' fertilizer application could have been deemed a "release" of a hazardous substance under CERCLA.[66]

Similarly, in 1997, a citizen's group sued Premium Standard Farms, Inc. (PSF), an AFO, claiming violations of the CAA, CWA, and CERCLA.[67] PSF was a Missouri swine operation holding nearly 1 million swine throughout 15 facilities.[68] In 1999, the EPA intervened and filed a complaint against PSF for violations of the CWA.[69] The EPA then issued Notices of Violation for failing to apply for preconstruction and operating permits under the CAA and for failure to follow the reporting requirements for ammonia under CERCLA section 103.[70] PSF eventually settled and entered into a consent degree that was "unprecedented" in the CAFO industry: "PSF is the first CAFO to agree to conduct source-specific emissions monitoring of its barns and lagoons."[71] PSF has since been bought and merged into the Smithfield Foods organization, the world's largest producer of pork products.[72]

The relevant theme throughout these cases is that the EPA has the authority under its most prominent environmental laws to regulate air and water pollution from animal agriculture. What is also clear is that

---

65. City of Waco v. Schouten, 385 F. Supp. 2d 595 (W.D. Tex. 2005).

66. *Id.*

67. Consent Decree at 4, Citizens Legal Envtl. Action Network, Inc. v. Premium Standard Farms, Inc., No. 97-6073-CV-SJ-6, 2000 U.S. Dist. LEXIS 1990 (W.D. Mo. Feb. 23, 2000), *available at* http://www.epa.gov/oecaerth/resources/decrees/civil/mm/psfcd.pdf.

68. Complaint at 7, Citizens Legal Envtl. Action Network, Inc. v. Premium Standard Farms, Inc., No. 97-6073-CV-SJ-6, 2000 U.S. Dist. LEXIS 1990 (W.D. Mo. Feb. 23, 2000), *available at* http://www.epa.gov/compliance/resources/cases/civil/mm/psfcp.pdf.

69. *Id.* at 1.

70. Consent Decree at 5–6, Citizens Legal Envtl. Action Network, Inc. v. Premium Standard Farms, Inc., No. 97-6073-CV-SJ-6, 2000 U.S. Dist. LEXIS 1990 (W.D. Mo. Feb. 23, 2000), *available at* http://www.epa.gov/oecaerth/resources/decrees/civil/mm/psfcd.pdf.

71. Michele Merkel, *Raising a Stink: Air Emissions from Factory Farms*, ENVTL. INTEGRITY PROJECT, 9–10 (July 1, 2002), http://environmentalintegrity.org/pdf/publications/CAFO AirEmissions_white_paper.pdf.

72. PREMIUM STANDARD FARMS, http://www.psfarms.com/products.html (last visited Jan. 29, 2010). *See also* SMITHFIELD, http://www.smithfield.com/about/ (last visited Jan. 29, 2010).

many of these AFOs and CAFOs, which have become the industry norm over the past two decades, are now large enough and (when one operation is correctly considered as a single facility) emit enough pollution to meet threshold levels requiring reporting under CERCLA. Further, the EPA is able to use the CAA and CWA to hold these operations accountable for their pollution.

IV. GREENHOUSE GASES AND CLIMATE CHANGE

Earth's climate has had wide variations throughout its history. Mankind has recently become aware that human activity brought on by the Industrial Revolution (beginning in the late 1800s) has affected the composition of our atmosphere—and very likely has and is influencing our climate.[73]

A. Greenhouse Gases: What They Are and How They Work

Any gas that absorbs infrared radiation in the atmosphere is referred to as a greenhouse gas.[74] Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC), ozone (O_3), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF_6).[75] Solar radiation (i.e., energy) passes through these gases in our clear atmosphere and is mostly absorbed by the earth's surface, generating a warming effect.[76] Some radiation is reflected back into the atmosphere, but the ever-increasing presence of these gases causes more of this radiation to be re-emitted in all directions, which means some of it goes back toward the surface and is partially absorbed, resulting in a greater warming effect.[77] As the concentration of greenhouse gases increases in the atmosphere, more solar radiation is emitted multiple times toward the earth's surface, resulting in a higher and higher percentage of that radiation being absorbed—and an overall increase in the planet's temperature.[78] The quantity of these gases released into the atmosphere has increased substantially over

73. U.S. ENVTL. PROT. AGENCY, *Climate Change–Basic Information*, *supra* note 14.

74. *Climate Change–Glossary*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/glossary.html (last updated Sept. 8, 2009).

75. *Id.*

76. *Climate Change–Science*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/science/index.html (last updated Aug. 19, 2010).

77. *Id.*

78. *Id.*

the last century, primarily from the burning of fossil fuels but a non-trivial percentage has come from agriculture (mostly methane).[79]

In 2007, the Intergovernmental Panel on Climate Change (IPCC), the leading international scientific body for the assessment of climate change,[80] stated that the increase in atmospheric temperatures since the mid-twentieth century was "very likely" the result of human activity in the form of increased emissions of these greenhouse gases.[81] Likewise, the concentrations of the two main culprits—CO_2 and methane, in 379 parts per million (ppm) and 1,774 parts per billion (ppb) respectively—"exceed by far the natural range over the last 650,000 years."[82]

Carbon dioxide enters the atmosphere as a result of the burning of fossil fuels such as oil and coal, the burning of solid waste and wood, and other chemical reactions (e.g., from manufacturing). Carbon dioxide is removed from the atmosphere when it is absorbed by plants as part of the biological carbon cycle.[83] Methane is emitted during the production and transport of coal, natural gas, and oil, although these emissions have been decreasing over time as production operations have captured more of the gas.[84] Methane emissions also emanate from animal and other agricultural practices, as noted earlier, and by the decay of organic waste in landfills.[85]

B. Greenhouse Gas Emissions in the United States

Total anthropogenic (i.e., from human activity) greenhouse gas emissions in the United States increased more than 14 percent from 1990 to 2007.[86] Total emissions declined 2.2 percent from 2007 to 2008 although the majority of that decrease was from reduced CO_2 emissions.[87] Methane emissions, which accounted for 10.5 percent of the 2008 total,

---

79. *Id.*; *Climate Change 2007: Synthesis Report-Summary for Policymakers*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 5 (2007), http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf [hereinafter IPCC Summary].

80. The IPCC was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socioeconomic impacts. *See Organization*, INTERNATIONAL PANEL ON CLIMATE CHANGE–IPCC, http://www.ipcc.ch/organization/organization.shtml (last visited Jan. 30, 2011).

81. IPCC Summary, *supra* note 79.

82. *Id.*

83. *Climate Change–Greenhouse Gas Emissions*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/emissions/index.html (last updated Oct. 19, 2010).

84. *Id.*

85. *Id. See also* discussion *supra* Part II.C.

86. USEIA 2008, *supra* note 9, at 1.

87. *Id.*

actually increased 2 percent since 2007.[88] While much of that increase was attributed to the energy sector (e.g., petroleum extraction operations), methane emissions from energy sources have remained relatively flat since 1990—gradually declining from 1990 to 2003, then slowly increasing again since then.[89] However, methane emissions from animal agriculture rose 11.7 percent from 1990 to 2008 and increased steadily and consistently during that time as a result of the shift to larger animal feeding operations (AFOs and CAFOs).[90]

To add some perspective, the 213.1 MMTCDE of methane emitted by animal agriculture in 2008 is 16 percent more than all natural gas operations in the United States combined, 61.5 percent more than all coal mining operations, and only 28 percent less than emissions from the entire energy sector.[91]

C. Climate Change: Magnitude and Impact

In 2007, the IPCC also stated that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."[92] Many natural systems are now being impacted by this warming, such as decreased ground stability in mountain and permafrost regions, changes in Arctic and Antarctic ecosystems, changes in algal, plankton, and fish abundance, and related changes in ice cover, salinity, oxygen levels, and circulation.[93] The IPCC classifies as "very likely" that human influences have resulted in a rise in ocean levels over the past 50 years, "likely" that those activities contributed to changes in wind patterns, thereby affecting storm tracks and temperature patterns, and "more likely than not" that these activities have led to increased risk of heat waves, areas affected by drought over the past 40 years, and frequency of heavy precipitation events.[94]

---

88. *Id.*

89. *Id.* at 29. Methane emissions from energy sources started at 294.4 MMTCDE, hit a low of 274.5 MMTCDE in 2003, and rose to a new high of 295.7 MMTCDE in 2008. Interestingly, the 2003 lowpoint of the last two decades falls between M. King Hubbert's initial forecast (first stated in 1956, published in 1969) of global peak oil (the point in time when peak global oil production occurs), and the subsequent analysis of 2005 made later by his associate Ken Deffeyes. *See* KENNETH S. DEFFEYES, BEYOND OIL: THE VIEW FROM HUBBERT'S PEAK xi (2006).

90. *See supra* Part II.C; USEIA 2008, *supra* note 9, at 31.

91. USEIA 2008, *supra* note 9, at 30–31.

92. IPCC Summary, *supra* note 79, at 2.

93. *Id.*

94. *Id.*

IPCC projections, made with either high confidence or very high confidence, are that climate change impacts on North America would include: decreased snowpack in western mountains due to warming; increased winter flooding; decreased summer river flows (exacerbating competition for already over-allocated water resources); an increase in the number, intensity, and duration of heat waves in cities that already experience heat waves, with the potential for adverse health impacts as a result; and increased stress in coastal communities due to climate change impacts interacting with development and pollution.[95]

These impacts pale in comparison with others. For example, by 2020, between 75 million and 250 million Africans will be exposed to increased water stress due to climate change, and yields from rain-fed agriculture may be reduced by up to 50 percent by that time.[96] Asian populations will experience "[e]ndemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts."[97] Europe has already made great reductions in greenhouse gas emissions, but will experience increased health risks due to heat waves and the frequency of wildfires, as well as reduced snow cover (and associated tourism) and species losses (potentially 60 percent by 2080) in mountainous regions.[98] At the extreme, the Pacific Island nation of Tuvalu (population roughly 12,000) will be entirely underwater in the next 50 years based on current projections.[99]

While mitigation is the process by which we reduce emissions of these gases, adaptation is the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."[100] The IPCC states with high confidence that, while adaptation or mitigation alone cannot avoid all climate change impacts, together they can significantly reduce the risks.[101] Adaptation strategies include expanded rainwater harvesting, improved water storage and conservation techniques, adjustment of planting techniques and crop variety, relocation (as in the case of the

95. *Id.* at 11–12.

96. IPCC Summary, *supra* note 79, at 11.

97. *Id.*

98. *Id. See also Climate Change–Greenhouse Gas Emissions–Global Greenhouse Gas Data*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/emissions/globalghg.html (last updated Mar. 3, 2010).

99. Jonathan Adams, *Rising Sea Levels Threaten Small Pacific Island Nations*, N.Y. TIMES, May 3, 2007, http://www.nytimes.com/2007/05/03/world/asia/03iht-pacific.2.5548184.html.

100. IPCC 2007: CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 6 (M.L. Parry et al. eds., 2007).

101. IPCC Summary, *supra* note 79, at 19.

Tuvuluans), improved climate-sensitive disease surveillance and control, strengthening of energy transmission and distribution infrastructure, and shifting from dependence on single energy sources to increased utilization of renewables.[102] Governments may create incentives for mitigation action in a variety of ways, including, but not limited to, integration of climate policies within wider development policies, regulations and standards, taxes and charges, tradable permits,[103] financial incentives, voluntary agreements, information instruments, and research, development, and demonstration.[104]

Both short- and longer-term mitigation and adaptation strategies are important; however, in the short term, mitigation may be more critical in order to lessen the eventual severity of climate change impacts.[105] Many impacts may be avoided, reduced, or delayed by early mitigation.[106] Given the importance of early mitigation, the relatively short atmospheric life of methane,[107] and the large quantity of it emitted by U.S. animal agriculture,[108] prompt EPA regulation of methane from AFOs can have a significant positive impact on climate change.

V. REGULATING METHANE FROM AFOs UNDER THE CAA

A. An Overview of the CAA

The CAA is the federal environmental statute that regulates ambient air quality, stationary and mobile source emissions, and hazardous air pollutants.[109] The CAA sets forth permitting requirements to control ambient air quality and stationary source emissions.

The two permitting provisions in the CAA are the preconstruction permits under Title I, Parts C and D, and the operating permit under Title V.[110] The preconstruction permit provision applies to new sources or the modification of existing sources that emit a threshold level of pollutants.[111] The permit requirements address air-quality criteria for specific pollutants, "emissions of which . . . cause or contribute to air

102. *Id.*, at 15.
103. For example, cap and trade. *See* Executive Summary, American Clean Air and Security Act of 2009, H.R. 2454, 111th Cong. (2009), *available at* http://www.gop.gov/bill/111/1/hr2454.
104. IPCC Summary, *supra* note 79, at 18.
105. *Id.*, at 19.
106. *Id.*
107. *See infra* Part V.E.
108. *See supra* Part II.C.
109. 42 U.S.C. §§ 7401–7671q (2006).
110. *Id.* §§ 7475, 7503, 7661.
111. *Id.* § 7475.

pollution which may reasonably be anticipated to endanger public health or welfare."[112] The EPA has previously identified six "criteria pollutants"[113] subject to these permitting requirements: sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb).[114]

B. Greenhouse Gases and the CAA

In *Massachusetts v. EPA*, the Supreme Court found that greenhouse gases can be air pollutants covered by the CAA.[115] The Court held that the EPA administrator *must* determine whether or not emissions of greenhouse gases from new motor vehicles cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision.[116] Per the language of section 202(a) of the CAA, in making this decision, the administrator

> shall by regulation prescribe . . . in accordance with the provisions of this section, standards applicable to the emission of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, which in [his] judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare . . . .[117]

This decision resulted from a petition for rulemaking under section 202(a) filed by more than a dozen environmental, renewable energy, and other organizations.[118] While the facts of the case applied to new motor vehicles (mobile sources), the holding implies that the EPA can assert regulatory authority over greenhouse gases from stationary sources as well.[119]

On April 17, 2009, the EPA administrator signed proposed endangerment and "cause or contribute" findings for greenhouse gases under Section 202(a) of the CAA.[120] Following the 60-day public comment pe-

---

112. *Id.* § 7408(a)(1)(A).
113. *See* discussion of NAAQS, *infra* Part V.B.
114. 40 C.F.R. §§ 50.4–50.12 (2006).
115. Massachusetts v. EPA, 549 U.S. 497 (2007).
116. 42 U.S.C. § 7521(a)(1) (2006).
117. Massachusetts v. EPA, 549 U.S. at 506 (quoting 42 U.S.C. § 7521(a)(1)).
118. 549 U.S. 497.
119. *See* 40 C.F.R. §§ 50.4–50.12.
120. *Climate Change–Regulatory Initiatives–Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/climatechange/endangerment.html (last updated Dec. 23, 2010) [hereinafter U.S. ENVTL. PROT. AGENCY, *Climate Change–Regulatory Initiatives].*

riod ending June 23, 2009, the EPA carefully reviewed, considered, and incorporated public comments and has now issued final findings.[121] The Endangerment Finding reads as follows: "The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)—in the atmosphere threaten the public health and welfare of current and future generations."[122] On December 15, 2009, the final findings were published in the *Federal Register*; the final rule was effective January 14, 2010.[123]

The EPA thus has the authority and, in fact, is required to list methane as a criteria pollutant. Pursuant to section 108 of the CAA, this ruling enables the EPA to list each of these gases as criteria pollutants under the preconstruction and operating permit requirements and then would require the EPA to issue air quality criteria[124] for each of these six greenhouse gases within 12 months of listing them.[125] Upon issuance of these criteria, EPA also must set a national pollution limit sufficient to protect the public health and welfare pursuant to section 109.[126] Also under section 109, the EPA is required to set primary and secondary National Ambient Air Quality Standards (NAAQS) for criteria pollutants.[127] Primary NAAQS are the acceptable concentration of a pollutant in the ambient air that will protect the public health,[128] while secondary NAAQS are set at a level to protect the public welfare encompassing environmental and economic interests.[129] The EPA "cause or contribute" finding of December 2009 stated that the "Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution which threatens public health and welfare."[130] These pollutants appear to result from numerous or diverse mobile or station-

121. *Id.*; Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009) (codified at 40 C.F.R. ch. 1).

122. Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act, 74 Fed. Reg. at 66,496.

123. *Id.*

124. The CAA requires the EPA to set National Ambient Air Quality Standards for "pollutants considered harmful to public health and the environment." *National Ambient Air Quality Standards (NAAQS)*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/air/criteria.html (last updated June 3, 2010).

125. 42 U.S.C. § 7408(a)(1)–(2) (2006).

126. 42 U.S.C. § 7409 (2006).

127. *Id.*

128. 42 U.S.C. § 7409(b)(1).

129. 42 U.S.C. § 7409(b)(2).

130. U.S. ENVTL. PROT. AGENCY, *Climate Change–Regulatory Initiatives*, *supra* note 120.

ary sources, rendering the EPA's duty to list them nondiscretionary.[131] Since methane is emitted from both agricultural and mining sources, it would appear to satisfy the numerous or diverse requirement.[132] Section 109(b) bars the EPA from considering cost or technology in setting air-quality standards.[133]

Under section 110, once the EPA has promulgated standards for criteria pollutants, each state must then develop and implement a state implementation plan (SIP) to meet the NAAQS through enforceable emissions controls for pollution sources within that state.[134] One component of a SIP is the requirement that pollutant sources monitor and report their emissions.[135] Sources that emit or have the potential to emit 100 tons per year of a pollutant would be classified as major stationary sources in a nonattainment area,[136] requiring permits to operate.[137] Similarly, sources that emit or have the potential to emit 100 tons per year of a criteria pollutant would be classified as major emitting facilities in a "Prevention of Significant Deterioration" (PSD) area,[138] requiring issuance of preconstruction permits.[139] While the EPA may not consider cost nor technology in reviewing a SIP, states may grant variances to allow sources to seek relief from SIP provisions if those provisions are economically or technologically infeasible.[140] This means that a state with a strong animal agriculture industry may choose to grant such variances so as to not cripple an important part of its economy. While this illustrates the flexibility of the CAA, the EPA would still retain oversight authority over state plans by means of the SIP call process.[141]

C. States and Greenhouse Gas Initiatives

At the time of writing this article, only 14 states had no climate action plan either in place or in progress (three are in progress, 33 are in

131. 42 U.S.C. § 7408(a)–(b) (2006).
132. USEIA 2008, *supra* note 9, at 31.
133. 42 U.S.C. §§ 7408(a)(2), 7409(a)(2). *See also* Whitman v. Am. Trucking Ass'n, 531 U.S. 457 (2001).
134. 42 U.S.C. § 7410 (2006).
135. *Id.* at (a)(2)(F).
136. 42 U.S.C. § 7407(d)(1)(A)(i) (2006). A nonattainment area meets neither the primary nor secondary NAAQS for a criteria pollutant.
137. 42 U.S.C. § 7602(j) (2006).
138. 42 U.S.C. §§ 7470–7492 (2006). Prevention of Significant Deterioration (PSD) areas have better air quality than required by NAAQS.
139. 42 U.S.C. § 7479(1).
140. 42 U.S.C. § 7410(a)(2).
141. 42 U.S.C. § 7410(a)(3)(B). The SIP call process requires the EPA to review SIPs for compliance with the CAA, and subsequently require states to submit revisions where the SIP is found to be deficient.

place).[142] Twenty-three states had greenhouse gas emissions targets,[143] and only 10 states had neither a climate registry nor some form of emissions reporting.[144] Thirty-five states had some form of renewable and/or alternative energy portfolio standard.[145]

While states should be applauded for taking the initiative in these areas, greenhouse gas emissions should be regulated at a federal level for several reasons. First and foremost, air moves. Greenhouse gases emitted by one state do not impact just the greenhouse gas concentrations in that state; they impact concentrations in the entire country—and the world, for that matter. Regulation at the federal level makes sense when concentrations of pollutants do not respect state borders. Second, federal regulation need not be onerous or one-size-fits-all. The CAA works in part because states create their own SIPs,[146] which can be tailored (as in the case of methane emitted from animal agriculture) to the level and importance of that industry in each state.[147] Third, federal regulation would eliminate the potential competitive economic imbalance between states that regulate and those that do not. Finally, it would be more efficient for the EPA to provide the framework within which states can draft plans, as well as emissions monitoring and reporting systems, and targets and caps for methane.

D. The EPA: Authority to Regulate Pollution from Animal Agriculture

As described above, CERCLA, the CWA, and the CAA each can be used to control pollution emanating from animal agriculture.[148] One potential impediment to this regulation is the Animal Feeding Operation Consent Agreement, under which the EPA compromised some of its

142. *Climate Action Plans*, PEW CTR. ON GLOBAL CLIMATE CHANGE, http://www.pewclimate.org/what_s_being_done/in_the_states/action_plan_map.cfm (last visited Jan. 29, 2010).

143. *Greenhouse Gas Emissions Targets*, PEW CTR. ON GLOBAL CLIMATE CHANGE, http://www.pewclimate.org/what_s_being_done/in_the_states/emissionstargets_map.cfm (last visited Jan. 29, 2010).

144. *Greenhouse Gas Reporting and Registries*, PEW CTR. ON GLOBAL CLIMATE CHANGE, http://www.pewclimate.org/what_s_being_done/in_the_states/reporting_map.cfm (last visited Jan. 29, 2010).

145. *Renewable & Alternative Energy Portfolio* Standards, PEW CTR. ON GLOBAL CLIMATE CHANGE, http://www.pewclimate.org/what_s_being_done/in_the_states/rps.cfm (last visited Jan. 29, 2010).

146. 42 U.S.C. § 7410.

147. *Id.* at (a)(2).

148. *See* discussion *supra* Parts III.A, C.

ability to regulate animal agriculture from 2005 onward.[149] This agreement allowed the EPA to provide AFOs temporary immunity from civil liability under Title I, Parts C and D, and Title V of the CAA in exchange for AFOs allowing the EPA to monitor emissions at selected facilities.[150] The goal of the agreement was, in part, to "generate scientifically credible data to provide for the characterization of emissions from all major types of AFOs."[151] However, despite immunity from civil violations of permitting requirements under the CAA, the EPA reserved the right to criminally prosecute all cases that present "an imminent and substantial endangerment to public health, welfare or the environment."[152]

Further, the agreement only specifically exempted AFOs from civil violations relating to the emission of pollutants that were to be monitored under the agreement, namely volatile organic compounds[153] (which do not include methane), hydrogen sulfide, particulate matter, and ammonia.[154] Methane was not contemplated in the agreement, and language in the agreement specifically states that the EPA's releases and covenant not to sue do not extend to emissions of gases beyond the four named.[155]

This means the EPA would not be barred from enforcing the provisions of the CAA as they pertain to AFOs, even if these operations participated in the agreement, and the EPA did not cede the authority to regulate methane emissions from animal agriculture. In fact, since the agreement was published in the *Federal Register* in January 2005, one would argue the industry has been aware for more than five years of the EPA's interest in the actual quantity of its air emissions and the EPA's willingness to enforce the CAA in regard to them.

E. Immediacy in the Face of Climate Change: Early Mitigation

Perhaps the most compelling argument for the EPA to regulate methane from animal agriculture is that it is the most expedient way to start lowering our greenhouse gas emissions. The EPA has already is-

149. Animal Feeding Operations Consent Agreement and Final Order, 70 Fed. Reg. 4958 (Jan. 31, 2005).

150. *Id.* at 4960.

151. *Id.* at 4963.

152. *Id.*

153. Volatile organic compounds (VOC) are emitted as gases from certain solids or liquids. *See An Introduction to Indoor Air Quality (IAQ): Volatile Organic Compounds (VOCs)*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/iaq/voc.html (last updated Nov. 29, 2010).

154. Animal Feeding Operations Consent Agreement and Final Order, 70 Fed. Reg. 4958, 4963 (Jan. 31, 2005).

155. *Id.*

sued the endangerment finding[156] and, as discussed earlier, has the authority to regulate pollutants from animal agriculture.[157]

Expediency is important for early mitigation.[158] Methane concentrations in the atmosphere are currently near 1,800 ppb,[159] the equivalent of more than an additional 35–40 ppm CO_2 concentration.[160] While the current level of CO_2 in the atmosphere is over 380 ppm,[161] debate continues over the level that is safe for humankind long term. To prevent catastrophic global warming, some argue that this concentration should not exceed 450 ppm and, at some point, it must return to 350 ppm.[162]

As to why the immediate regulation of methane is more effective than regulating CO_2, the answer lies both in the relative potency of methane[163] and its atmospheric life. Methane remains in the atmosphere for roughly 9 to 15 years, in comparison with the approximate 100-year atmospheric life of CO_2.[164] In other words, reducing CO_2 emissions today will not have a significant impact for nearly 100 years. (Although we should still reduce them if we care about the planet 100 years from now.) Whereas, the reduction of methane emissions today will have beneficial impacts in the next 10 to 20 years. Therefore, if people are expected to make political, economic, and lifestyle sacrifices in order to lower emissions, the benefits will be seen in their lifetimes—a much more compelling argument.

Congress shows no indication of addressing climate change from a comprehensive perspective nor with a focus on methane emitted from animal agriculture. While H.R. 2454 (the American Clean Energy and Security Act) passed the U.S. House of Representatives in June 2009, the legislation applies only to the energy sector, and a corresponding Senate

156. U.S. ENVTL. PROT. AGENCY, *Climate Change–Regulatory Initiatives*, *supra* note 120.

157. *See* discussion *supra* Part V.D.

158. IPCC Summary, *supra* note 79, at 19. *See also* discussion *supra* Part III.C.

159. *Recent Greenhouse Gas Concentrations*, CARBON DIOXIDE INFO. ANALYSIS CTR., http://cdiac.ornl.gov/pns/current_ghg.html (last visited Jan. 29, 2010).

160. Methane is about 21 times as potent a greenhouse gas as carbon dioxide. *See Methane: Science*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/methane/scientific.html (last updated June 22, 2010).

161. CARBON DIOXIDE INFO. ANALYSIS CTR., *supra* note 159.

162. IPCC Summary, *supra* note 79, at 67. *See also* ELIZABETH KOLBERT, FIELD NOTES FROM A CATASTROPHE: MAN, NATURE, AND CLIMATE CHANGE 128 (2006).

163. U.S. ENVTL. PROT. AGENCY, *supra* note 160.

164. *Methane*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/methane/index.html (last updated June 22, 2010). *See also Current Greenhouse Gas Concentrations*, CARBON DIOXIDE INFO. ANALYSIS CTR., http://cdiac.ornl.gov/pns/current_ghg.html (last visited Feb. 3, 2010).

Bill was not even scheduled for hearings.[165] Even if Congress did act, it would likely be years before enforcement of any new laws could begin.[166] Therefore, the EPA's regulation of methane will have the most immediate positive effect on climate change, both because of the relatively short atmospheric lifetime of methane, as well as the relative speed with which the EPA can act.

F. Immediate Action: Validating the Copenhagen Conference

The U.N. Climate Summit in Copenhagen in December 2009 was historic; never before had so many world leaders attended a conference on climate change. Most commentators agreed the outcome was both an important first step, yet also not nearly enough to achieve the goal of keeping anthropogenic climate change to 2°C.[167] Congress, having passed no climate change legislation at the time of the conference, hamstrung the U.S. delegation, which was led by President Obama.[168] Further, it is uncertain if and when Congress will pass any such legislation, and how long it would take to become law.[169]

Barring disaster, the United States will remain one of the top emitters of greenhouse gases for the next decade, the most critical time for world leaders to reach a binding agreement on the overall reductions in emissions to prevent a 2°C temperature increase.[170] For the United States to retain credibility in any bargaining or leadership position, we must begin reducing emissions as soon as possible, in the most expeditious way possible. With the uncertainty of congressional action, EPA regulation is the most expedient, effective way to begin. By regulating methane from animal agriculture, the EPA would not impact the critical energy

---

165. *See* Executive Summary, American Clean Air and Security Act of 2009, H.R. 2454, 111th Cong. (2009), *available at* http://www.gop.gov/bill/111/1/hr2454. H.R. 2454 represented comprehensive energy legislation to deploy clean energy resources, increase energy efficiency, cut global warming pollution, and transition to a clean energy economy.

166. JOHN V. SULLIVAN, HOW OUR LAWS ARE MADE, H.R. Doc. No. 110-49 (2007), *available at* http://thomas.loc.gov/home/lawsmade.toc.html. *See also Climate Action in Congress*, PEW CTR. ON GLOBAL CLIMATE CHANGE, http://www.pewclimate.org/what_s_being_done/in_the_congress (last visited Jan. 30, 2010).

167. *See, e.g.*, John Vidal et al., *Low Targets, Goals Dropped: Copenhagen Ends in Failure*, GUARDIAN, Dec. 19, 2009, *available at* http://www.guardian.co.uk/environment/2009/dec/18/copenhagen-deal. *See also* CHRISTIAN EGENHOFER & ANTON GEORGIEV, THE COPENHAGEN ACCORD: A FIRST STAB AT DECIPHERING THE IMPLICATIONS FOR THE EU (Dec. 25, 2009), *available at* http://www.ceps.eu/ceps/download/2830.

168. *Id.*

169. *See* discussion *supra* Part V.E.

170. IPCC Summary, *supra* note 79, at 19. *See also* discussion *supra* Part III.C.

sector and would not risk being preempted by Congress should any of the currently proposed climate legislation pass.[171]

G. The Impact on Animal Agriculture: Relatively Minor

Animal agriculture in general, and AFOs and CAFOs in particular, generate a disproportionate amount of greenhouse gas in the form of methane when compared with the number of jobs supported and the percentage contributed to the GDP.[172] Economic considerations aside, the industry should face increased regulation because: (1) this industry can use readily available technology to comply with regulation of their methane emissions, and (2) animal agriculture can reintegrate with crop growers based on the shifting economic decisions that would result from increased regulation.

Technology to capture, process, and exploit animal waste has existed for years.[173] "Anaerobic digesters" compost organic waste in a machine that limits access to oxygen and encourages the generation of methane and CO_2 by the microbes in the waste itself.[174] This gas is then burned as fuel to make electricity. These digesters are primarily designed for and used at solid waste landfills, as well as for animal waste from farms.[175] However, their use at AFOs and CAFOs is still somewhat limited, mainly due to their initial high cost of implementation as well as the fact that they take up more land that could otherwise be used to spread manure or house more (profit-generating) animals.[176]

Solutions exist, however. The USDA Natural Resources Conservation Service (NRCS) administers the Environmental Quality Incentives Program (EQIP), a "voluntary conservation program that promotes agricultural production and environmental quality as compatible National goals."[177] Farmers and ranchers can apply for and receive financial and technical help through EQIP to implement conservation practices on ag-

---

171. *See* discussion *supra* Part V.E.

172. *See* discussion *supra* Part II.C.

173. *See, e.g.*, *Turn Manure into Energy*, SLURRYSTORE, http://www.slurrystore.com/Anaerobic_Digesters.html (last visited Jan. 30, 2010).

174. *Anaerobic Digesters*, ENERGY JUSTICE NETWORK, http://www.energyjustice.net/digesters/ (last visited Jan. 30, 2010).

175. *Id.*

176. *Id. See also* Maria Alicia Gaura, *270 Cows Generating Electricity for Farm: Methane Digester Also Breaks Down Waste*, S.F. CHRON., May 14, 2004, at B-1, *available at* http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2004/05/14/METHANE.TMP. A digester system for a relatively small 270-cow organic dairy cost $280,000. *Id.*

177. *See Environmental Quality Incentives Program*, U.S. DEP'T AGRIC. NATURAL RESOURCES CONSERVATION SERV., http://www.nrcs.usda.gov/programs/eqip (last updated Dec. 9, 2010).

ricultural land.[178] EQIP was reauthorized in the Food, Energy and Conservation Act of 2008[179] (Farm Bill). EQIP can pay for up to 75 percent of incurred costs and income foregone for specific conservation practices, such as installing anaerobic digesters. Certain historically underserved producers can receive payments of up to 90 percent of these costs.[180] According to the EPA, approximately 150 anaerobic digester projects are now operational thanks in part to federal programs such as these.[181]

Were the EPA to begin regulating methane emissions, investment in technologies such as these digesters would become more attractive, as AFOs and CAFOs would have to factor in the potential costs of environmental fines. The federal government is already assisting farmers in taking these steps through the EQIP program; EPA regulation would merely advance that process. In short, AFOs and CAFOs have a government-subsidized technological solution available to them to quickly comply with EPA regulation of methane emissions under the CAA. An added benefit not related to methane, but germane to greenhouse gas emissions in general, is that if farms could generate their own electricity this way, they could also reduce their overall load on the power grid.

Critics argue that the CAA is the wrong tool with which to regulate greenhouse gases. One industry attorney notes that "[t]he act was never meant to regulate a pollutant emitted in the quantities of CO_2, especially when no control technology exists."[182] Methane is emitted in quantities much less than CO_2 however,[183] and the control technology does exist.

Vertically integrated AFOs and CAFOs have become the dominant model in animal agriculture in America over the past 20 years.[184] This occurred for the most part because these operations are more profitable than the alternative: a "family style" farm.[185] A "family style" farm is where livestock and crops are grown on the same plot of land, thereby eliminating lagoons and providing an immediate use for animal waste as fertilizer.[186] Obviously, these horizontally integrated sustainable opera-

178. *Id.*
179. *Id.*
180. *Id.*
181. AgSTAR, U.S. Envtl. Prot. Agency, Federal Incentives for Developing Anaerobic Digester Systems, Apr. 2010, www.epa.gov/agstar/documents/agstar_federal_incentives.pdf.
182. Robin Bravender, *EPA: Pace of Clean Air Act Rulemakings Turns Heads, Draws Lawsuits*, Greenwire, Sept. 14, 2010, http://www.eenews.net/Greenwire/2010/09/14/2/ (quoting Joseph Stanko).
183. *See* discussion *supra* Part II.C.
184. *See* discussion *supra* Part II.A.
185. Brehm, *supra* note 27 at 798–99.
186. Brehm, *supra* note 27 at 797 n.1.

tions, which provide a use for animal waste, and which avoid the methane-intense lagoons,[187] would become more economically attractive were the EPA to start regulating methane emissions and force large agribusinesses to factor in the costs of potential fines. In effect, the EPA, through this one form of regulation, could reverse the shift of production, from highly polluting, vertically integrated operations back to smaller, sustainable farms. These smaller, sustainable farms also generally allow animals to roam freely, not in the confinement situations found in CAFOs.[188] Animals roaming freely spread their own manure; the tradeoff for producers becomes the increased land needed for free roaming of livestock versus the costs of setting up lagoons and treatment systems. EPA regulation and the costs associated with compliance could, again, shift the balance in favor of more-sustainable operations.

VI. CONCLUSION

The vertical integration of the animal agriculture industry over the past two decades has led to changes in pollution. The increased prevalence of AFOs and CAFOs means a greater percentage of the industry emits air pollution on an industrial level, and more of that pollution is methane. The sources of the increased methane are the water-driven lagoons that are, for the moment, a cost-effective way to manage animal waste at these facilities.

Methane is roughly 21 times as potent a greenhouse gas as CO_2, yet also has an atmospheric lifetime less than one-fifth that of CO_2. Because of these two factors, even relatively small (in absolute terms) decreases in methane emissions will have a faster, more profound effect on climate change.

The EPA has both the authority to treat AFOs and CAFOs as industrial polluters under the CAA, as well as to regulate greenhouse gas emissions following their recent endangerment finding. Caselaw over the last decade also indicates the EPA can prevail in regulating animal agriculture.

Animal agriculture is a relatively small component of the U.S. economy, and solutions exist for agribusiness to lower methane emissions from AFOs and CAFOs. These include technological solutions, business model solutions, and even federal programs to assist agribusinesses in this transition.

For all these reasons, in addition to the lack of congressional leadership addressing climate change, the EPA should move to immediately

187. MARKS & NATURAL RESOURCES DEF. COUNCIL, *supra* note 21.
188. *Id.*

regulate methane emissions from AFOs and CAFOs under the CAA. In addition to the short- and long-term benefits to the environment, this could also serve as both a model for other industries to follow, as well as provide Congress an impetus to act sooner in the area of climate change.