MISSING THE BOAT ON PROTECTING HUMAN HEALTH AND THE ENVIRONMENT: A RE-EVALUATION OF THE EPA'S EMISSIONS POLICY ON LARGE OCEAN-GOING VESSELS

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Air pollution is the inevitable consequence of neglect. . . .
It will be controlled when the people of America . . . demand the right to air that they and their children can breathe without fear.[1]

I. INTRODUCTION

The international shipping industry serves as the backbone of global commerce. The industry is responsible for transporting approximately eighty percent of all trade volume to and from the United States, and approximately ninety percent of all trade volume among the members of the European Community.[2] Between 1983 and 1998, world seaborne trade increased by seventy percent.[3] Over the last decade, the industry has continued to grow at a steady annual rate of five percent.[4] This growth has resulted in significant port expansion around the United States and abroad, and a concomitant increase in harmful vessel emissions.[5] Despite the existence of strict national and international regulations aimed at reducing emissions from motor vehicles, refineries, and other land-based industry, engines used on large ocean-going vessels ("OGVs") remain largely unregulated.[6]

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1. Lyndon B. Johnson, Remarks upon Signing the Air Quality Act of 1967, 2 PUB. PAPERS 1067, 1069 (Nov. 21, 1967). More than forty years later the agency charged with protecting the nation's air quality continues to neglect a major source of air pollution.

2. INT'L COUNCIL ON CLEAN TRANSP. [ICCT], AIR POLLUTION AND GREENHOUSE GAS EMISSIONS FROM OCEAN-GOING SHIPS: IMPACTS, MITIGATION OPTIONS AND OPPORTUNITIES FOR MANAGING GROWTH 7 (2007), *available at* http://theicct.org/documents/48_06_ICCT_OceanReportComplete_04-4_taiwanRev.pdf.

3. BLUEWATER NETWORK, A STACKED DECK: AIR POLLUTION FROM LARGE SHIPS 1 (2000), *available at* http://www.bluewaternetwork.org/reports/rep_ss_ships_stackeddeck.pdf.

4. ICCT, *supra* note 2, at 4.

5. *See* DIANA BAILEY ET AL., NATURAL RES. DEF. COUNCIL [NRDC], HARBORING POLLUTION: STRATEGIES TO CLEAN UP U.S. PORTS 1 (2004), *available at* http://www.nrdc.org/air/pollution/ports/ports2.pdf (discussing reasons for growth of emissions around ports). *See generally* MAR. ADMIN., U.S. DEP'T OF TRANSP., U.S. WATER TRANSPORTATION STATISTICAL SNAPSHOT (May 2008), *available at* www.marad.dot.gov/documents/US_Water_Transportation_Statistical_snapshot.pdf [hereinafter DOT I] (compiling statistics demonstrating growth of shipping industry in recent years).

6. *See* Control of Emissions from New Marine Compression-Ignition Engines at or Above 30

OGVs utilize large diesel engines that burn enormous volumes of the dirtiest and least expensive fuels available, which contain sulfur quantities several thousand times greater than that found in fuels used in other vehicles.[7] As a result, OGVs significantly contribute to ozone (O_3), carbon monoxide (CO), carbon dioxide (CO_2), nitrogen oxides (NO_x), nitrous oxide (N_2O), sulfur oxides (SO_x), and particulate matter ("PM") inventories over oceans, in maritime ports, and near coastal communities.[8] These emissions harm the environment and negatively impact human health.[9] The impacts are particularly acute near maritime ports and coastal areas because approximately seventy to eighty percent of all OGV emissions occur there.[10] In some coastal areas, OGV emissions are so significant that they reduce ambient air quality levels below that required by land-based emission regulations.[11]

As ports continue to expand to accommodate the increase in seaborne trade, and air pollution regulations continue to focus on land-based emissions, the shipping industry's contribution as a percentage of total anthropogenic air pollution is anticipated to grow significantly.[12] Left unchecked, OGV emissions will add considerably to local air quality problems.[13] To offset the increased

Liters per Cylinder, 68 Fed. Reg. 9746, 9747 (Feb. 28, 2003) [hereinafter EPA Final Rule 2003] (noting EPA has not previously regulated engines used on large ocean-going vessels). The EPA classifies engines as Category I, II, or III, based on each engine's per-cylinder displacement. *Id.* at 9758. The largest—Category III marine diesel engines—are "used primarily for propulsion power on ocean-going vessels such as container ships, tankers, bulk carriers, and cruise ships." *Id.* at 9747.

7. ICCT, *supra* note 2, at 9.

8. BAILEY ET AL., *supra* note 5, at 2; Paul Jun et al., *CO_2, CH_4, and N_2O Emissions from Transportation-Water-Borne Navigation*, *in* BACKGROUND PAPERS: IPCC EXPERT MEETINGS ON GOOD PRACTICE GUIDANCE AND UNCERTAINTY MANAGEMENT IN NATIONAL GREENHOUSE GAS INVENTORIES 71, 72 (2000), *available at* http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/2_4_Water-borne_Navigation.pdf.

9. Int'l Maritime Org. [IMO], *Prevention of Air Pollution from Ships: Revision of the NO_x Technical Code: Tiers* [sic] *2 Emission Limits for Diesel Marine Engines at or Above 130 kW*, at 2, MEPC 44/11/7 (Dec. 24, 1999), *available at* http://www.epa.gov/OMSWWW/regs/nonroad/marine/ci/final-nox-submittal-12-99.pdf [hereinafter IMO Tier 2].

10. ICCT, *supra* note 2, at 5; *see also* S. COAST AIR QUALITY MGMT. DIST., MULTIPLE AIR TOXICS EXPOSURE STUDY (MATES-II) ES-3 (2000), *available at* http://www.aqmd.gov/matesiidf/es.pdf (noting approximately seventy percent of risk of getting cancer in California from breathing toxins in air is associated with diesel fuel exhaust particles, and finding excessively high incidence of cancer in communities adjacent to ports in Los Angeles).

11. IMO, *Review of MARPOL Annex VI and the NO_x Technical Code: Development of Standards for NO_x, PM, and SO_x*, at 3, BLG 11/5/15 (Feb. 9, 2007), *available at* http://www.epa.gov/oms/regs/nonroad/marine/ci/blg11-05-15-nox-pm-sox-united.states.pdf [hereinafter IMO NO_x I].

12. COMPARING FUEL CONSUMPTION, CO_2 AND OTHER EMISSIONS FROM INTERNATIONAL SHIPPING AND AIRCRAFT FOR THE YEAR 2000: A SUMMARY OF RECENT RESEARCH FINDINGS BY VERONIKA EYRING AND JAMES J. CORBETT (2007), http://www.pa.op.dlr.de/SeaKLIM/Fuel_Emissions_International_Shipping.html [hereinafter EYRING & CORBETT] (noting CO_2 and SO_2 emissions from ships, left unchecked, "could double present-day values by 2050, and NO_x emissions could exceed present-day global road transport").

13. *Id.*

emissions expected from the industry's growth, significant reductions of the quantities of harmful substances emitted by OGVs are needed.

Despite recognizing in 1994 that marine diesel emissions pose a significant threat to human health and the environment, the Environmental Protection Agency ("EPA") has repeatedly failed to promulgate emission regulations for OGVs. In direct contravention of its mandate to protect public health and the environment from harmful pollutants, the EPA continues to defer to weak international emissions regulations that elevate foreign interests over the health and welfare of American citizens and the environment. As a result, millions of Americans continue to suffer from, or develop, health-related problems directly attributable to exposure to harmful OGV emissions. Moreover, the EPA's failure to regulate one of the largest sources of greenhouse gasses will directly contribute to the wide-ranging environmental destruction expected to result from climate change.

This Article examines the impact of OGV emissions on human health and the environment, with emphasis on the EPA's role to protect American citizens and the environment from harm. Part II provides an overview of the pollutants contained in OGV emissions, and examines the health and environmental impacts of exposure to those pollutants. Part III examines the current and anticipated level of OGV activity within U.S. waters. Part IV evaluates existing national and international emission regulations applicable to OGVs transiting U.S. waters, and examines recently proposed amendments to MARPOL Annex VI. Part V provides recommendations for action, and argues that the EPA must immediately establish a comprehensive national program to regulate OGV emissions to fulfill its mandate under the Clean Air Act ("CAA") to protect human health and preserve the environment.

II. HEALTH AND ENVIRONMENTAL IMPACTS OF OGV EMISSIONS

Pursuant to its mandate under the CAA, the EPA has established National Ambient Air Quality Standards ("NAAQS") for air pollutants considered harmful to public health and the environment.[14] Of these so-called criteria pollutants, SO_2, O_3, PM, NO_x, and CO are emitted from diesel engines used by OGVs.[15] Marine diesel emissions contribute to nonattainment of the NAAQS for PM and O_3, particularly in commercial ports and along coastal areas.[16] According to the EPA, air pollution from OGVs represents a "significant source

14. *See* 42 U.S.C. § 7408(a) (2006) (directing EPA to establish list of regulated pollutants and emissions limits); *id.* § 7409(b) (directing EPA to establish ambient air quality standards stringent enough to protect public health).

15. *See* BAILEY ET AL., *supra* note 5, at 2 (listing pollutants emitted around shipping ports); EPA, NATIONAL AMBIENT AIR QUALITY STANDARDS (2009), http://www.epa.gov/air/criteria.html (listing criteria pollutants regulated by EPA).

16. EPA, EPA420-R-08-006, SUMMARY AND ANALYSIS OF COMMENTS: CONTROL OF EMISSIONS OF AIR POLLUTION FROM LOCOMOTIVE ENGINES AND MARINE COMPRESSION IGNITION ENGINES LESS THAN 30 LITERS PER CYLINDER, CHAPTER 2: AIR QUALITY AND HEALTH IMPACTS 2-1 (2008), *available at* http://www.epa.gov/otaq/regs/nonroad/420r08006chp2.pdf; *see also* EPA Final Rule 2003, *supra* note 6, at 9747 (discussing particular effects of pollution along coastal areas).

of damage to human health and welfare on a global scale, and its overall contribution is rapidly growing."[17] Studies show that exposure to OGV emissions is harmful to human health and the environment.[18]

A. SO_x Emissions

Sulfur oxides are molecules of sulfur and oxygen created during the combustion of fossil fuels.[19] Sulfur dioxide (SO_2) is the predominant form found in the atmosphere near ground.[20] SO_2 absorbed on air-borne particles can be transported deep into the pulmonary system, and result in respiratory illness, irritation of the eyes, nose, and throat, and premature mortality.[21] Children, the elderly, and those already suffering from respiratory illness are at the highest risk.[22] Most impacts appear to be linked to acute exposure to high concentrations of SO_2 and other sulfur oxides, which exist when OGVs are in port.[23]

Sulfur oxide emissions also damage the environment and infrastructure. Some sulfur oxides emitted into the air undergo chemical transformations before settling into water bodies as strong acids.[24] These acids significantly alter water chemistry, resulting in physiological responses that render plants and animals more susceptible to disease, competition, and other environmental phenomena that impact their ability to survive.[25] Because few species can survive large shifts in pH, acidification of lakes and other environments decreases species abundance and diversity.[26] Additionally, exposure to acid accelerates the corrosion of metals and the erosion of other materials that compose the infrastructure of communities.[27]

17. IMO NO_x I, *supra* note 11, at 2.

18. IMO, *Prevention of Pollution from Ships: Air Pollution from Shipping Emissions - Environmental Justice: Public Health and Community Impacts*, at 1, MEPC 53/4/8 (May 12, 2005), *available at* http://www.bluewaternetwork.org/reports/cv/imoejsubmission.pdf.

19. WORLD BANK GROUP, POLLUTION PREVENTION AND ABATEMENT HANDBOOK 1998: TOWARD CLEANER PRODUCTION 231 (1999), *available at* http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1999/06/03/000094946_9904090505 2283/Rendered/PDF/multi0page.pdf.

20. *Id.*

21. *Id.* at 231–32.

22. *Id.* at 231.

23. *Id.* at 232.

24. EPA, Sulfur Dioxide: Health and Environmental Impacts of SO_2, http://www.epa.gov/air/urbanair/so2/hlth1.html (last visited May 19, 2009) [hereinafter EPA SO_2 I].

25. *See* Scott C. Doney et al., *Impact of Anthropogenic Atmospheric Nitrogen and Sulfur Deposition on Ocean Acidification and the Inorganic Carbon System*, 104 PROC. NAT'L ACAD. SCI. 14580, 14583–84 (2007), *available at* http://www.pnas.org/content/104/37/14580.full.pdf (noting detrimental effects of sulfur oxides and other acids on plant and animal life).

26. WORLD BANK GROUP, *supra* note 19, at 232.

27. *Id.*

B. NO_x, CO Emissions, and Ozone

Nitrogen oxides emissions are dangerous as a result of their ability to react with other gases in the atmosphere to cause ground-level ozone.[28] Ozone is primarily created by a chemical reaction between oxides of nitrogen and other volatile organic compounds ("VOCs") in the presence of sunlight.[29] CO also contributes to the formation of ground-level ozone when emitted, but then the molecule is converted to CO_2.[30] Large diesel engines used by OGVs are major sources of NO_x and VOC,[31] and a minor source of CO.[32]

Smog is primarily comprised of ground-level ozone.[33] Breathing ozone has been linked to decreased lung function, increased respiratory symptoms, and increased risk of premature death.[34] Ozone exacerbates bronchitis, emphysema, and asthma, and repeated exposure may permanently scar lung tissue.[35] Because ozone formation is greater in warm weather, active adults and children who spend most of their summer playing outdoors are at the greatest risk of exposure.[36] Studies show that approximately "one out of every three people in the United States is at a higher risk of experiencing ozone-related health effects."[37] In 2007, approximately half the U.S. population (144 million) lived in areas that violated air quality standards for ground-level ozone.[38]

Many plant species suffer cellular damage when exposed to ozone that harms their leaves and interferes with their ability to produce and store food.[39] This renders the plant more susceptible to disease, predation, pollution, and other physical phenomena that negatively impact growth rates, crop yields, and, ultimately, species diversity.[40] In the United States alone, agricultural exposure

28. EPA, EPA-456/F-98-005, NO_x: HOW NITROGEN OXIDES AFFECT THE WAY WE LIVE AND BREATHE 3 (1998), *available at* http://www.epa.gov/air/urbanair/nox/noxfldr.pdf.

29. EPA, Ground-Level Ozone, http://www.epa.gov/groundlevelozone (last visited May 19, 2009) [hereinafter EPA Ozone I].

30. Jun et al., *supra* note 8, at 75.

31. *See* EPA Ozone I, *supra* note 29 (noting that vehicle exhaust is one cause of harmful ozone).

32. *See* Jun et al., *supra* note 8, at 75 (noting OGVs generally emit carbon monoxide in limited circumstances, such as when idle, or at low speed).

33. EPA Ozone I, *supra* note 29.

34. EPA, Health and Environmental Impacts of NO_x, http://www.epa.gov/air/urbanair/nox/hlth.html (last visited May 19, 2009) [hereinafter EPA NO_x].

35. EPA, EPA-452/F-99-003, OZONE AND YOUR HEALTH, *available at* http://www.epa.gov/air/ozonepollution/pdfs/health.pdf [hereinafter, EPA OZONE II].

36. *Id.*

37. EPA, EPA-452/K-99-001, SMOG—WHO DOES IT HURT? WHAT YOU NEED TO KNOW ABOUT OZONE AND YOUR HEALTH 2 (1999), *available at* http://www.epa.gov/air/ozonepollution/pdfs/smog.pdf.

38. JAMES E. MCCARTHY, CONG. RESEARCH SERV., RL34057, CRS REPORT FOR CONGRESS: OZONE AIR QUALITY STANDARDS: EPA'S 2007 PROPOSED CHANGES 3 (2007), *available at* http://www.ncseonline.org/NLE/CRSreports/07Nov/RL34057.pdf.

39. EPA, Health and Environment: Ground-Level Ozone, http://www.epa.gov/air/ozonepollution/health.html (last visited May 19, 2009).

40. *Id.*

to ozone results in an estimated $500 million in reduced crop production each year.[41]

Like sulfur oxides, nitrogen oxides emitted into the air undergo chemical transformations before settling into water bodies as strong acids.[42] The presence of acids in water alters the water chemistry, which triggers physiological responses that can ultimately threaten the survival of plants and animals by increasing their susceptibility to disease, competition, and other environmental phenomena.[43] Additionally, these emissions cause significant quantities of nitrogen to be deposited into water bodies, which leads to eutrophication in some areas.[44]

In high concentrations, CO negatively impacts the cardiovascular and central nervous systems.[45] CO emissions also impact the ability of other gases in the air to destroy methane molecules.[46] Additionally, CO contributes to the formation of ground-level ozone, which can trigger a host of serious health problems.[47]

C. Particulate Matter Emissions

Particulate matter is a mixture of extremely small particles and liquid droplets consisting of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.[48] The volume of PM emitted from engines is directly correlated with the sulfur level of the fuels used.[49] PM represents a serious health hazard primarily because of its ability to settle deep within the bronchi and lungs in humans and cause physiological change.[50] Asthma, lung cancer, cardiovascular disease, and premature death have all been linked to the inhalation of PM.[51] Additionally,

41. EPA, Basic Information, http://www.epa.gov/air/ozonepollution/basic.html (last visited May 19, 2009).

42. EPA SO_2 I, *supra* note 24.

43. *See* Doney et al., *supra* note 25, at 14583–34 (reporting results of study on ocean acidification and finding acid to be "significant threat to ecosystems").

44. According to the U.S. Geological Survey, "[e]utrophication is a process whereby water bodies . . . receive excess nutrients that stimulate excessive plant growth," which, in turn, "reduces dissolved oxygen in the water when dead plant material decomposes," resulting in the death of fish and shellfish populations. U.S. Geo. Survey, Toxic Substances Hydrology Program: Eutrophication, http://toxics.usgs.gov/definitions/eutrophication.html (last visited May 19, 2009); *see also* EPA NO_x, *supra* note 34 (noting airborne nitrogen oxides cause majority of Chesapeake Bay's nitrogen pollution).

45. EPA, Carbon Monoxide: Health and Environmental Impacts of CO, http://www.epa.gov/air/urbanair/co/hlth1.html (last visited May 19, 2009) [hereinafter EPA CO].

46. Jun et al., *supra* note 8, at 75.

47. EPA CO, *supra* note 45.

48. EPA, Particulate Matter, http://www.epa.gov/oar/particlepollution (last visited May 19, 2009) [hereinafter EPA PM I].

49. BLUEWATER NETWORK, *supra* note 3, at 5.

50. EPA, Health and Environment, http://www.epa.gov/oar/particlepollution/health.html (last visited May 19, 2009) [hereinafter EPA PM II].

51. JONATHAN M. SAMET ET AL., HEALTH EFFECTS INST., THE NATIONAL MORBIDITY,

increased hospital admissions for asthma, lung disease, pneumonia, and heart disease, and decreased school attendance, have been correlated with the level of PM present in the ambient air.[52] Long-term exposure to PM is associated with cardiovascular-related death, cardiopulmonary disease, increased respiratory symptoms, decreased lung function, lung cancer, and cardiac abnormalities.[53] In 2007, approximately "88 million people live[d] in areas that violate[d] air quality standards from PM."[54]

PM is the primary cause of reduced visibility throughout the United States.[55] When this material settles on the ground it can deplete nutrients in the soil and cause damage to sensitive forests and farm crops.[56] When it settles in water bodies, it can acidify the water and alter the nutrient balance to the extent that species diversity is negatively impacted.[57] PM may also cause aesthetic damage by staining or damaging stone and other materials.[58]

D. Climate Change and OGV Emissions

Global atmospheric concentrations of CO_2 and unknown quantities of nitrous N_2O and CH_4 have "increased markedly . . . since 1750, and now far exceed pre-industrial values."[59] These gases accumulate in the atmosphere with other greenhouse gases and act to absorb terrestrial radiation reflected from the Earth's surface that, in turn, causes global temperatures to rise.[60] OGV engines emit significant quantities of CO_2 and lesser quantities of N_2O and CH_4.[61] OGVs also release significant quantities of black carbon ("BC"), which recent studies

MORTALITY, AND AIR POLLUTION STUDY: PART II: MORBIDITY AND MORTALITY FROM AIR POLLUTION IN THE UNITED STATES 42 (2000), *available at* http://www.cabq.gov/airquality/pdf/samet2.pdf; Hélène Desqueyroux et al., *Short-Term Effects of Low-Level Air Pollution on Respiratory Health of Adults Suffering from Moderate to Severe Asthma*, 89 ENVTL. RES. 29, 35 (2002).

52. *See* Frank D. Gilliland et al., *The Effects of Ambient Air Pollution on School Absenteeism Due to Respiratory Illnesses*, 12 EPIDEMIOLOGY 43, 48–49 (2001) (finding that daily variation in PM level is associated with school absences); Joel Schwartz, *Air Pollution and Hospital Admissions for Heart Disease in Eight U.S. Counties*, 10 EPIDEMIOLOGY 17, 20 (1999) (finding association between PM and CO presence and hospital admissions).

53. C. Arden Pope III et al., *Lung Cancer, Cardiopulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution*, 287 J. AM. MED. ASS'N 1132, 1136 (2002), *available at* http://jama.ama-assn.org/cgi/reprint/287/9/1132.

54. EPA, EPA420-F-07-015, REGULATORY ANNOUNCEMENT: EPA PROPOSAL FOR MORE STRINGENT EMISSIONS STANDARDS FOR LOCOMOTIVES AND MARINE COMPRESSION-IGNITION ENGINES 2 (Mar. 2007), *available at* http://www.epa.gov/otaq/regs/nonroad/420f07015.pdf.

55. EPA PM II, *supra* note 50.

56. *Id.*

57. *Id.*

58. *Id.*

59. Intergovernmental Panel on Climate Change [IPCC], *Climate Change 2007 - The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the IPCC*, at 2 (2007) [hereinafter IPCC, *Climate Change 2007*].

60. *See* EPA, Greenhouse Gas Emissions, http://epa.gov/climatechange/emissions/index.html (last visited May 19, 2009) [hereinafter EPA Climate Change I] (providing overview of greenhouse gas causes and tracking methods).

61. Jun et al., *supra* note 8, at 72.

suggest may play a major role in global warming.[62] The contribution of each pollutant is discussed below.

1. Carbon Dioxide Emissions

CO_2 is the principal carbon-based pollutant of concern with regard to global warming.[63] The global atmospheric concentration of CO_2 has increased from a pre-industrial volume of 280 parts per million ("ppm") to 379 ppm in 2005.[64] Atmospheric CO_2 concentrations are higher today that at any time in the last 650,000 years, and the increase is believed to be due primarily to the increased burning of fossil fuels.[65] Despite international efforts to reduce CO_2 emissions, in 2007 global CO_2 emissions from all industry sectors increased by nineteen billion tons.[66]

Ninety-nine percent of the carbon in fuel oil used by OGVs converts to CO_2 through combustion.[67] While the shipping industry "generally produces less CO_2 per tonne kilometre than any other form of transportation," the contribution is significant.[68] CO_2 emissions from the international shipping industry currently exceed total greenhouse gas emissions from most of the nations listed in the Kyoto Protocol as Annex I countries.[69] According to one estimate, the shipping industry emits up to three percent of the total world inventory of greenhouse

62. V. Ramanathan & G. Carmichael, *Global and Regional Climate Changes Due to Black Carbon*, 1 NATURE GEOSCIENCE 221, 221 (2008), *available at* http://www.nature.com/ngeo/journal/v1/n4/pdf/ngeo156.pdf.

63. IPCC, *Climate Change 2007*, *supra* note 59, at 2.

64. *Id.*; *see also* EPA Climate Change I, *supra* note 60 (noting increase in carbon dioxide emissions in recent years).

65. IPCC, *Climate Change 2007*, *supra* note 59, at 2.

66. NAT'L OCEANIC & ATMOSPHERIC ADMIN. [NOAA], CARBON DIOXIDE, METHANE RISE SHARPLY IN 2007 (2008), http://www.noaanews.noaa.gov/stories2008/20080423_methane.html [hereinafter NOAA METHANE].

67. 1 EPA, COMPILATION OF AIR POLLUTANT EMISSION FACTORS § 1.3.3.7 (5th ed. & Supp. 1998), *available at* http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf.

68. HANS OTTO KRISTENSEN, FORCE TECH., FORCE No. 107-27476/HOK/2007-10-31, CO_2 INDEXING PRINCIPLES AND HISTORICAL DEVELOPMENT OF ENERGY EFFICIENCY OF SHIPS 8 (2007), *available at* http://www.forcetechnology.com/NR/rdonlyres/4B14D2E4-E333-472F-8C5D-1F6E20E4F5F1/0/FinalreportCO2IndexproposalHOK31thOctober2007.pdf.

69. ICCT, *supra* note 2, at 5. Annex I countries are the industrialized nations that have agreed to reduce their emissions to levels below their 1990 emissions. United Nations Framework Convention on Climate Change art. 4(2), *done* May 9, 1992, S. TREATY DOC. NO. 102-38, 1771 U.N.T.S. 107, *available at* http://unfccc.int/resource/docs/convkp/conveng.pdf [hereinafter UNFCCC]. These countries include: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States of America, and, separately, the European Union. *Id.* at Annex I.

gases.[70] However, the industry may actually emit twice that amount, making it a larger emitter of greenhouse gases than all but six countries in the world.[71]

2. Nitrous Oxide and Methane Emissions

The global atmospheric concentration of N_2O has increased from a pre-industrial value of 270 parts per billion ("ppb") to 319 ppb in 2005, and continues to slowly increase.[72] CH_4 has increased from a pre-industrial value of 715 ppb to 1774 ppb in 2005, and is now more abundant in the Earth's atmosphere than at any time in the past 650,000 years.[73] In 2007, global atmospheric CH_4 "rose by twenty-seven million tons after nearly a decade with little or no increase."[74]

Currently, little is known about the volume of N_2O and CH_4 emitted annually from OGVs. However, the impact of these emissions should not be discounted even though they may be negligible when compared to CO_2 emissions. This is because both gases have a greater ability to trap heat within the atmosphere than CO_2. For example, the ability of N_2O to trap heat over time is about 270 times more powerful than that of CO_2.[75] Similarly, the ability of CH_4 to trap heat over time is about twenty-one times more powerful than that of CO_2.[76] Because global concentrations of N_2O and CH_4 continue to rise, any additional contribution from the shipping industry is problematic.[77]

3. Nitrogen Oxides, Carbon Monoxide, and Ozone

Although not generally associated with global warming, the contribution of NO_x and CO to climate change is significant because each gas plays a role in the production of the greenhouse gas ozone.[78] CO modulates the production of atmospheric methane, which is also an important greenhouse gas.[79] Both ozone and methane absorb incoming solar radiation and terrestrially emitted radiation,

70. EYRING & CORBETT, *supra* note 12, at 1.

71. Rachel Oliver, *Shipping's Impact on the Air*, CNN.COM, Jan. 20, 2008, http://edition.cnn.com/2008/WORLD/asiapcf/01/20/eco.about.ships (reporting information obtained from internal memorandum issued by industry member suggesting shipping accounts for five to six percent of all greenhouse gases).

72. IPCC, *Climate Change 2007*, *supra* note 59, at 3.

73. *Id.*

74. NOAA METHANE, *supra* note 66.

75. Union of Concerned Scientists, Global Warming: Emissions of Heat-Trapping Gases and Aerosols, http://www.ucsusa.org/global_warming/science/emissions-of-heattrapping-gases-and-aerosols.html (last visited May 19, 2009).

76. *Id.*

77. *See* EPA, Atmosphere Changes, http://epa.gov/climatechange/science/recentac.html (last visited June 6, 2009) [hereinafter EPA Climate Change II] (describing increase in concentration of certain greenhouse gases).

78. *See* NASA Jet Propulsion Laboratory, Tropospheric Emission Spectrometer: Ozone and Its Precursors and Sinks, http://tes.jpl.nasa.gov/mission/O3SourceSink (last visited May 19, 2009) (discussing role of NO_x and CO in Tropospheric Ozone).

79. NOAA, Greenhouse Gases: Frequently Asked Questions, Carbon Monoxide and Other Reactive Gases, http://lwf.ncdc.noaa.gov/oa/climate/gases.html#co (last modified Aug. 20, 2008) [hereinafter NOAA Greenhouse Gases].

thereby contributing to climate change.[80] Atmospheric levels of NO_x have steadily increased over the last three decades, and this increase is projected to continue.[81] Although difficult to measure accurately, atmospheric CO concentrations appear to be declining.[82] However, the Northern Hemisphere contains about twice as much CO as the Southern Hemisphere because the human activity that produces much of the global burden of CO is located there.[83]

4. Black Carbon

OGVs also release large quantities of black carbon, also known as soot, which results from the incomplete combustion of low-grade fuel, particularly the lowest grade bunker fuel used by OGVs.[84] Scientists believe that BC plays a significant role in global warming, based on its ability to absorb and retain heat.[85] Studies have shown that BC's contribution to climate change is second only to CO_2.[86] In fact, BC may be responsible for almost twenty percent of the warming the planet is currently experiencing.[87] The impact is particularly acute in the Arctic, where BC settles onto ice and snow and reduces their natural reflectivity, which, in turn, increases their rate of melting.[88] While the sources of BC are diverse and spread around the world, the shipping industry represents a significant source and may account for all BC emitted over the world's oceans.[89]

Recently, a panel of international scientists examined a massive brown haze flowing across the East China Sea past the Korean Peninsula.[90] The panel opined that "[b]lack carbon is probably the most insidious component of the haze as far as health is concerned; it is also the most important factor in terms of climate

80. IMO, *Prevention of Air Pollution from Ships: MARPOL Annex VI - Proposal to Initiate a Revision Process*, at annex 2, MEPC 53/4/4 (Apr. 15, 2005) [hereinafter IMO NO_x II]; EPA, Methane: Science, http://epa.gov/methane/scientific.html (last visited July 6, 2009).

81. NOAA, EARTH SYS. RESEARCH LAB., THE NOAA ANNUAL GREENHOUSE GAS INDEX (AGGI) fig. 2, http://www.esrl.noaa.gov/gmd/aggi/ (last visited June 15, 2009).

82. NOAA Greenhouse Gases, *supra* note 79.

83. *Id.*

84. *EPA Black Carbon and Global Warning: Hearing Before the H. Comm. on Oversight and Government Reform*, 110th Cong. 2–3 (2007) (opening statement of Rep. Henry A. Waxman, Chairman, H. Comm. on Oversight and Government Reform), *available at* http://oversight.house.gov/documents/20071127165326.pdf.

85. *Id.* at 52 (testimony of Dr. V. Ramanathan, Professor of Climate and Atmospheric Sciences, Scripps Institute of Oceanography, University of San Diego).

86. *Id.*

87. *Id.* at 1 (opening statement of Rep. Waxman).

88. *Id.* at 68 (statement of Dr. Charles Zender, Associate Professor of Earth System Science, University of California at Irvine).

89. Letter from Oceana, Friends of the Earth, Center for Biological Diversity, and Earthjustice to Stephen L. Johnson, Adm'r, EPA (Oct. 3, 2007), *available at* http://www.oceana.org/fileadmin/oceana/uploads/Climate_Change/Marine_GHG_Petition_FINAL.pdf (petitioning EPA for rulemaking under Clean Air Act regarding emissions from marine shipping vessels).

90. Veerabhadran Ramanathan, Dir., The Ctr. for Atmospheric Sci., Univ. of Cal., San Diego, Remarks at the Meeting of the American Academy (Nov. 21, 2005), *available at* http://www.amacad.org/publications/bulletin/spring2006/12globalwarming.pdf.

change."[91] The panel noted that as a result of long range transport, pollutants in the haze are traveling across the ocean and are impacting land masses, including the United States. Another study found that BC deposition was a primary factor in the rapid loss of critical habitat in the Arctic.[92] Given these and other studies that suggest that reducing BC emissions may have a dramatic, immediate impact on global warming, BC must be considered in any plan to regulate OGV emissions.

E. Future Impacts of OGV Emissions

The international shipping industry currently contributes approximately nine percent of the world's SO_x emissions,[93] eighteen to thirty percent of the world's NO_x emissions,[94] and millions of tons of PM and its associated BC.[95] One study suggests that the industry may account for three percent of all global greenhouse gas emissions.[96] However, another study from the International Association of Independent Tanker Owners that was leaked to the press suggests that the shipping industry may actually account for five to six percent of all greenhouse gas emissions.[97]

By 2030, OGVs may account for approximately eighty-three percent of SO_x emissions, twenty-eight percent of all mobile-source NO_x emissions, and twenty percent of all mobile-source PM in the United States alone.[98] Left unchecked, CO_2 and SO_x emissions from the industry are anticipated to double by 2050, and NO_x emissions are expected to exceed that emitted from all global road transport.[99] The impact will likely be greatest near deep water ports that accommodate OGVs, because in 2006 more than thirty deepwater ports were located in areas which do not achieve NAAQS for PM and/or ozone.[100] However, the problem is not limited to port areas alone. By 2020, for example, the EPA projects that sixty-seven percent of NO_x in Santa Barbara County, California, an area with no commercial ports, will come from ships transiting the California coast.[101]

91. *Id.* at 37.

92. KASSIE SIEGEL ET AL., CTR. FOR BIO. DIVERSITY, CLIMATE, AIR, & ENERGY PROGRAM, NOT TOO LATE TO SAVE THE POLAR BEAR: A RAPID ACTION PLAN TO ADDRESS THE ARCTIC MELTDOWN 10 (2007), *available at* http://www.biologicaldiversity.org/swcbd/programs/policy/energy/ArcticMeltdown.pdf.

93. IMO NO_x I, *supra* note 11, at 2.

94. *Id.*

95. *See generally* IMO NO_x I, *supra* note 11 (describing OGVs as major contributors of PM).

96. EYRING & CORBETT, *supra* note 12, at 1; *see also* ICCT, *supra* note 2, at 5 (noting shipping industry contributes more emissions than many nations participating in Kyoto protocol as Annex I countries).

97. Oliver, *supra* note 71.

98. IMO NO_x I, *supra* note 11, at 2.

99. EYRING & CORBETT, *supra* note 12, at 1.

100. IMO, *Review of MARPOL Annex VI and the NO_x Technical Code: Air Quality Concerns from Particulate Matter and Oxides of Sulphur*, at 4, BLG 11/5/27 (Feb. 23, 2007).

101. *Marine Vessel Emissions Reduction Act of 2007: Hearing on S.1499 Before the S. Comm. on*

The impact from OGV emissions is wide ranging and affects the health and welfare of people throughout the United States. Moreover, if left unchecked, OGV emissions may indirectly contribute to food shortages in the United States and abroad. Studies suggest that if fossil fuel emissions continue to increase as expected, global average ozone levels will rise by approximately fifty percent by 2100 and cause global crop production to fall by eight percent.[102] Additionally, because they emit significant quantities of heat-trapping greenhouse gases, if left unchecked OGVs will add to the warming the Earth is currently experiencing and significantly contribute to the environmental damage expected to result from climate change.

III. OGV ACTIVITY IN UNITED STATES WATERS

A. Trade Volume and Industry Expansion

The United States is the largest importer, and third largest exporter, of goods in the world.[103] Between 2002 and 2006, water-borne foreign imports to the United States increased by twenty-one percent, from 848.2 million metric tons ("mmt") to 1,025.9 mmt.[104] U.S. exports increased nearly thirteen percent, from 348.7 mmt to 393.6 mmt during that same period.[105] As a result of this increase, vessel activity at U.S. ports has steadily increased. In 2007, for example, 6,867 OGVs made 63,804 calls at U.S. ports.[106] This marked a 12.7% increase in all vessels' calls at U.S. ports from five years earlier.[107] The largest increase has been observed in container trade. Between 2002 and 2007, international container trade increased by fifty-one percent.[108] The Department of Transportation anticipates that by 2020, on average, activity at every major U.S. container port will double in volume.[109] Activity in ports along the east coast is

Environment and Public Works, 110th Cong. (2008) (statement of Bryan Wood-Thomas, Associate Director, Office of Transportation and Air Quality, Office of Air and Radiation, EPA, *available at* http://epa.gov/ocirpage/hearings/testimony/110_2007_2008/2008_0214_bwt.pdf) [hereinafter *S. Hearing*].

102. J. Reilly et al., *Global Economic Effects of Changes in Crops, Pasture, and Forests Due to Changing Climate, Carbon Dioxide, and Ozone*, 35 ENERGY POL'Y, 5370, 5375 fig.1(c), 5378–79 (2007).

103. *See* World Trade Org. [WTO], *Trade Profile: United States* (Apr. 2009), http://stat.wto.org/CountryProfile/WSDBCountryPFView.aspx?Language=E&Country=US (reporting that in 2007 United States imported 14.16% and exported 8.30% of all goods exchanged on world markets).

104. DOT I, *supra* note 5, at 1.

105. *Id.*

106. OFFICE OF POLICY & PLANS, U.S. DEP'T OF TRANSP., VESSEL CALLS AT U.S. PORTS: SNAPSHOT, 2007, at 1 (2008), *available at* http://marad.dot.gov/documents/Vessel_Calls_at_US_Ports_Snapshot.pdf [hereinafter DOT II].

107. *Id.*

108. DOT I, *supra* note 5, at 3.

109. *Short Sea Shipping Opportunities in the United States: Hearing Before the Subcomm. on Coast Guard and Maritime Transportation of the H. Comm. on Transportation and Infrastructure*,

expected to triple, while activity in some west coast ports may quadruple.[110] Overall, compared to tonnages recorded in 2001, total freight moved through U.S. ports is anticipated to increase by more than fifty percent by 2020.[111]

To accommodate the increase in seaborne trade, shipbuilders have increased the size of ships used to carry goods. In the last five years, the average size of container ships has increased by twenty-five percent.[112] Next-generation container ships with even larger capacities are already under contract for construction.[113] During this same period, U.S. port calls by the largest container ships increased by a staggering 241%.[114] These changes have placed increasing pressure on ports throughout the nation to expand existing facilities or build new ones. Currently, the twenty-three largest ports in the country handle approximately forty percent of the international trade and domestic commerce, but the impacts of shipping are experienced along the entire U.S. coastline.[115] Shipping affects the west coast, with ports from Washington to California; the gulf coast, with ports in Texas and Louisiana; and the east coast, with major ports in Florida, Georgia, South Carolina, North Carolina, Virginia, Maryland, Washington, D.C., Pennsylvania, New York, and New Jersey.[116] In the last four years alone, port authorities allocated $10.6 billion to expand or develop port facilities.[117] The effort has been insufficient to keep up with demand, and shortfalls in port capacity are expected in all regions of the country by 2010.[118] Industry studies show that the United States must continue to expand its overall port volume capacity by ten percent yearly just to sustain the expected growth in seaborne trade.[119]

B. Cruise Industry

In addition to calls at port from OGVs involved in seaborne trade, large cruise ships frequently visit U.S. ports. Because passenger vessels, on average, burn more of the same dirty fuel used by other OGVs to travel the same distance, their emissions are significant.[120] Ports already struggling to keep pace

110th Cong. 59 (2007) (statement of Sean T. Connaughton, Administrator, Maritime Administration, Department of Transportation) [hereinafter *H. Hearing*].

110. *Id.*

111. *Id.*

112. DOT I, *supra* note 5, at 5.

113. MAR. ADMIN., U.S. DEP'T OF TRANSP., REPORT TO CONGRESS ON THE PERFORMANCE OF PORTS AND THE INTERMODAL SYSTEM 11 (2005), *available at* http://marad.dot.gov/documents/Rpt_to_Congress-Perf_Ports_Intermodal_Sys-June2005.pdf [hereinafter DOT III].

114. DOT I, *supra* note 5, at 5.

115. *See* DOT III, *supra* note 113, at 6 tbl.1 (detailing total cargo throughput for twenty-three U.S. ports in 2002).

116. *Id.*

117. MAR. ADMIN., U.S. DEP'T OF TRANSP., UNITED STATES PUBLIC PORT DEVELOPMENT EXPENDITURE REPORT 16 (2005).

118. DOT III, *supra* note 113, at 29.

119. *H. Hearing*, *supra* note 109, at 60.

120. *See* TAPANI STIPA ET AL., SHIPNOEM PROJECT, EMISSIONS OF NO_x FROM BALTIC SHIPPING

with the demand in seaborne trade have the added burden of accommodating the needs of the rapidly growing cruise industry and assimilating the large volume of pollution associated therewith.

Since 1970, the cruise industry has experienced a staggering 2,100% growth.[121] Annual passenger embarkations have increased from 500,000 in 1970 to more than twelve million in 2006.[122] Most of this growth has occurred in the last decade. As of the end of 2007, roughly half (88 of the 173) of the ships composing the cruise industry's global fleet will have been introduced since 2000.[123] U.S ports have experienced the largest share of the industry's growth. Over the last decade, cruise lines have been expanding the number of home ports for their fleets to reduce vessel congestion and to make it easier for passengers to get to the ports.[124] As a result, embarkations at U.S. ports increased by over four percent in 2006, to nine million passengers, and accounted for seventy-five percent of total global embarkations.[125] Currently, a combined fleet of 118 large cruise ships offer North American cruises that visit at least one U.S. port.[126]

Because eighty-three percent of U.S. adults have never taken a cruise, and interest in doing so remains high, the industry continues to build additional high-capacity ships to accommodate expected future growth.[127] Worldwide, the cruise industry is expected to increase passenger-carrying capacity from its current level to somewhere between 19.3 and 30.1 million by 2020.[128] To accommodate this increase, between 40 and 120 additional vessels will need to be placed in service over the next fifteen years.[129] This, in turn, will create further demand for new port facilities and require expansion of existing facilities.[130] Given the strong domestic interest in cruising, it appears likely that a majority of this increased

AND FIRST ESTIMATES OF THEIR EFFECTS ON AIR QUALITY AND EUTROPHICATION OF THE BALTIC SEA 12 tbl.6 (2007), *available at* http://www.helcom.fi/stc/files/shipping/NOx%20emissions.pdf (indicating passenger ships had highest fuel usage and second highest NO_x emissions of all vessels evaluated).

121. CRUISE LINES INT'L ASS'N [CLIA], CRUISE INDUSTRY SOURCE BOOK 8 (2007), *available at* http://www.cruising.org/press/sourcebook2007/2007sourcebook.pdf [hereinafter CLIA I].

122. *Id.*

123. *Id.*

124. OFFICE OF POLICY & PLANS, U.S. DEP'T OF TRANSP., NORTH AMERICAN CRUISE STATISTICS SNAPSHOT, 2ND QUARTER 2007, at 1 (2008) [hereinafter DOT IV].

125. CLIA, *Study Results Detail Cruise Industry's $35.7 Billion Contribution to U.S. Economy*, CRUISE NEWS, Aug. 29, 2007, http://www.cruising.org/cruisenews/news.cfm?NID=310 [hereinafter CLIA II].

126. OFFICE OF POLICY & PLANS, U.S. DEP'T OF TRANSP., NORTH AMERICAN CRUISE STATISTICS SNAPSHOT, 4TH QUARTER 2008, at 2 tbl.1 (2009).

127. *See generally* CLIA I, *supra* note 121, at 8, 17–60 (identifying future cruise ship orders for all member cruise lines).

128. BERMELLO-AJAMIL & PARTNERS, INC., 2006 PORT OF LOS ANGELES CRUISE STUDY 6 (2006), *available at* http://www.portoflosangeles.org/DOC/REPORT_Cruise_Study_2006_Full_Report.pdf [hereinafter L.A. PORT STUDY].

129. *Id.*

130. *Id.*

development and activity will occur at U.S. ports. This increased vessel activity will likely result in substantial health and environmental impacts.

C. Age of OGV Fleet

As OGVs have increased in size, emissions have also increased because there are generally no requirements that ships use more efficient emission control technologies.[131] In 2007, more than fifty-three percent of the calls at U.S. ports were made by vessels less than ten years old.[132] Approximately twenty-six percent of calls were made by vessels between ten and twenty years old.[133] The average age of all OGVs calling on U.S. ports in 2007 was 11.1 years.[134] The average life expectancy of OGVs in 2006 was approximately 32.6 years.[135] These numbers show that the majority of OGVs currently in service are likely to continue emitting enormous volumes of toxic pollutants into the skies for decades if left unregulated.

D. Foreign-Flagged Vessel Impact

To engage in international commerce in international waters, all OGVs are required to have a country of registry.[136] Between 2002 and 2007, U.S.-flagged vessel calls at U.S. ports decreased 1.2%, while vessel capacity increased 8.5%.[137] The number of OGVs registered in the United States that called on U.S. ports in 2007 declined by approximately three percent from 2002.[138] In contrast, foreign-flagged vessel calls at U.S. ports between 2001 and 2005 increased 5.7%, while vessel capacity increased 13.2%.[139] In 2007, 88.4% of all commercial OGVs that called on U.S. ports were not registered in the United States.[140] With one exception, every ship that composes the North American cruise industry is foreign-flagged.[141] These numbers demonstrate that foreign nations are

131. *See* STIPA ET AL., *supra* note 120, at 2 (noting that largest contribution—thirty-two percent—of NO_x from all shipping sectors originated from ships built after 2000).

132. DOT II, *supra* note 106, at 3.

133. *Id.*

134. *Id.* at 4.

135. NIKOS E. MIKELIS, A STATISTICAL OVERVIEW OF SHIP RECYCLING tbl.3 (2007), *available at* http://www.imo.org/includes/blastDataOnly.asp/data_id=19934/200709SSE07Astatisticaloverviewofshiprecycling.pdf.

136. CLIA, Technical & Regulatory: Background - Maritime Industry, http://www.cruising.org/industry/maritime_industry.cfm (last visited May 20, 2009) [hereinafter CLIA III].

137. DOT II, *supra* note 106, at 2, 8.

138. *Id.* at 8.

139. MAR. ADMIN., U.S. DEP'T OF TRANSP., VESSEL CALLS AT U.S. & WORLD PORTS 2005, at 2 (2006).

140. DOT II, *supra* note 106, at 7.

141. *See* Erica Silverstein, *What's Wrong with Hawaii?*, CRUISE CRITIC, Mar. 3, 2008, http://www.cruisecritic.com/news/news.cfm?ID=2420 (noting Norwegian Cruise Line intended to pull two of three U.S.-flagged ships out of service before summer 2008).

overwhelmingly responsible for the harmful pollutants emitted by OGVs in U.S. ports and along the U.S. coastline.

IV. REGULATION OF OGV EMISSIONS

A. International Regulation of OGV Emissions

1. UNCLOS III

The third United Nations Convention on the Law of the Sea ("UNCLOS III") established a method of governing international activities on, over, and beneath the ocean's surface.[142] Under UNCLOS III, all ships "enjoy the right of innocent passage" through the territorial sea of coastal states, provided their voyage "is not prejudicial to the peace, good order or security of the coastal State" and conforms with international law.[143] Such passage is considered to be prejudicial if while in the territorial sea the ship engages in, inter alia, "wilful and serious pollution contrary to [international law]."[144] A coastal state may take those steps necessary in its territorial sea to prevent passage that is not innocent, including enforcing its own environmental laws as long as those laws do not impact the construction, design, equipment, or manning of ships.[145] A state may require foreign ships to comply with that state's own pollution control standards as a condition of entry into its ports or internal waters.[146] Where the environment is particularly susceptible to harm from pollution, a state may designate a special area in which more stringent pollution regulations apply.[147]

2. IMO and MARPOL Annex VI

The International Maritime Organization ("IMO") is charged with developing and maintaining a comprehensive body of international conventions covering every facet of shipping, including pollution.[148] The principal international agreement relating to pollution from ships is the International Convention for the Prevention of Pollution from Ships, created in 1973, as modified by the Protocol of 1978 relating thereto (collectively "MARPOL").[149]

142. United Nations Convention on the Law of the Sea, *done* Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS III]. The Convention came into force on November 16, 1994. Jonathan I. Charney, *Entry into Force of the 1982 Convention on the Law of the Sea*, 35 VA. J. INT'L L. 381, 381 (1995).

143. UNCLOS III, *supra* note 142, arts. 17, 19(1).

144. *Id.* art. 19(2)(h).

145. *Id.* art. 21(1)(f), (2).

146. *See id.* art. 25(2) (noting coastal state may take steps necessary to prevent breach of admissibility conditions).

147. *Id.* art. 211(6)(a).

148. The IMO is a United Nations organization created by international convention in 1948. Convention on the Intergovernmental Maritime Consultative Organization, *done* Mar. 6, 1948, 9 U.S.T. 621, 289 U.N.T.S. 3.

149. International Convention for the Prevention of Pollution from Ships, Nov. 2, 1973, 34 U.S.T

Under MARPOL, each member is required to control discharges from its own ships, regardless of location, and is required to enforce MARPOL provisions against all ships subject to MARPOL in their own territorial waters regardless of the flag of registry.[150] As originally enacted, MARPOL consisted of five separate annexes designed to combat a particular class of pollutants, including oil (Annex I), harmful substances carried in bulk (Annex II), harmful substances in packaged form (Annex III), ship-generated sewage (Annex IV), and garbage (Annex V).[151] The United States has adopted Annexes I, II, and V, and enforces the provisions of each Annex against all vessels subject to MARPOL that operate within U.S. waters.[152]

In 1997, the IMO adopted Annex VI to deal with air pollution from ships.[153] Annex VI sets limits on sulfur oxide and nitrogen oxide emissions, and prohibits the deliberate emission of ozone-depleting substances.[154] The Annex does not address PM, BC, CO, CO_2, N_2O, or CH_4. As enacted, Annex VI required that the sulfur content of fuel oil used by ships be capped at 45,000 ppm.[155] Annex VI also provided for the establishment of special Sulphur Emission Control Areas ("SECAs") in environmentally vulnerable areas.[156] All ships traveling within a SECA, regardless of country of registry, are required to either utilize fuel oil with a sulfur content not exceeding 15,000 ppm or employ exhaust gas cleaning systems that limit sulfur emissions to comparable levels.[157] To date, SECAs have been established for the North Sea and the Baltic Sea.[158] Annex VI entered into force internationally on May 19, 2006, but the United States Senate Foreign Relations Committee delayed ratification despite the recommendation of

3407, 1313 U.N.T.S 3 (entered into force Mar. 30, 1983); Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, *done* Feb. 17, 1978, 34 U.S.T. 3407, 1340 U.N.T.S. 61, *available at* http://www.imo.org/Conventions/mainframe.asp?topic_id=258&doc_id=678 [hereinafter MARPOL].

150. *See generally* IMO, International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL), http://www.imo.org/Conventions/mainframe.asp?topic_id=258&doc_id=678 (last visited May 27, 2009) (providing terms of MARPOL that collectively require enforcement).

151. *Id.*

152. The United States adopted Annexes I, II, and V of MARPOL by amending the Act to Prevent Pollution from Ships. 33 U.S.C. §§ 1901–1915 (2006).

153. IMO, The Protocol of 1997: Annex VI Regulations for the Prevention of Air Pollution from Ships, http://www.imo.org/Conventions/mainframe.asp?topic_id=258&doc_id=678#30 (last visited June 16, 2009) [hereinafter MARPOL Annex VI]; Constantine G. Papavizas & Lawrence I. Kiern, *2005-2006 U.S. Maritime Legislative Developments*, 38 J. MAR. L. & COM. 267, 286–87 (2007).

154. MARPOL Annex VI, *supra* note 153; IMO, Annex VI: Prevention of Air Pollution from Ships, http://www.imo.org/Conventions/mainframe.asp?topic_id=258&doc_id=678#11 (last visited June 16, 2009).

155. *See* MARPOL Annex VI, *supra* note 153 (imposing sulfur content cap of 4.5% m/m).

156. *Id.*

157. *Id.*

158. Press Briefing, IMO, IMO Environment Meeting Approves Revised Regulations on Ship Emissions (Apr. 4, 2008), *available at* http://www.imo.org/About/mainframe.asp?topic_id=1709&doc_id=9123 [hereinafter IMO Environment].

President Bush to do so as early as 2003.[159] In July 2008, President Bush signed enabling legislation for Annex VI into law.[160]

B. Domestic Regulation of OGV Emissions

As originally enacted, the Clean Air Act applied only to land-based industry and road-based mobile sources of pollution.[161] As part of the 1990 amendments to the CAA, Congress added section 213, which requires the EPA to evaluate the impact of emissions from nonroad engines[162] and nonroad vehicles[163] on state pollution inventories.[164] Under section 213, if the emission of CO, NO_x, or VOC from these sources is found to significantly contribute to ozone or CO in more than one nonattainment area,[165] the EPA Administrator is required to promulgate emission standards "equivalent in stringency to standards for comparable motor vehicles or engines" for these sources.[166] Section 213 also provides the Administrator with the discretion to regulate other emissions from these sources upon a finding that the emissions contribute to air pollution that "may reasonably be anticipated to endanger public health or welfare."[167]

Section 211 of the CAA provides the Administrator with discretion to regulate fuels, and to prohibit the sale or use of any fuel or fuel additive used in any nonroad engine, that "causes, or contributes, to air pollution which may reasonably be anticipated to endanger the public health or welfare."[168] The Administrator may place caps on the composition of fuels used, and may place caps on the sulfur content of fuels.[169]

On April 2, 2007, the Supreme Court ruled that section 202(a) of the CAA authorizes the EPA "to regulate greenhouse gas emissions from new motor

159. *See* Message to the Senate Transmitting the Protocol of 1997 to Amend the International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978, 39 WEEKLY COMP. PRES. DOC. 609 (May 15, 2003) (recommending that Senate ratify 1997 Protocol).

160. Maritime Pollution Prevention Act of 2007, H.R. 802, 110th Cong. (2007). That bill amended the Act to Prevent Pollution from Ships to provide for the adoption of Annex VI of the MARPOL. In 2008, H.R. 802 passed the Senate and was signed by the President. Maritime Pollution Prevention Act of 2008, Pub L. No. 110-280, 122 Stat. 2611 (to be codified at 33 U.S.C. §§ 1901–1905, 1907, 1910).

161. *See* 42 U.S.C. § 7401(a)(2) (2006) (attributing pollution to industrial development and motor vehicles).

162. *Id.* § 7550(10) (defining "nonroad engine" as "an internal combustion engine (including the fuel system) that is not used in a motor vehicle or a vehicle used solely for competition, or that is not subject to standards promulgated under section 7411 of this title or section 7521 of this title").

163. *Id.* § 7550(11) (defining "nonroad vehicle" as "a vehicle that is powered by a nonroad engine and that is not a motor vehicle or a vehicle used solely for competition").

164. *Id.* § 7547(a)(1).

165. *Id.* § 7547(a)(2).

166. 42 U.S.C. § 7547(a)(3).

167. *Id.* § 7547(a)(4).

168. *Id.* § 7545(c)(1)(A).

169. *Id.* § 7545(i).

vehicles in the event that [the Administrator] forms a 'judgment' that such emissions contribute to climate change."[170] The Court held that the

> EPA can avoid taking further action [to regulate harmful emissions from new motor vehicles] only if it determines that greenhouse gases do not contribute to climate change or if it provides some reasonable explanation as to why it cannot or will not exercise its discretion to determine whether they do.[171]

On December 11, 2007, a federal court dismissed a lawsuit filed by automakers designed to block California from implementing regulations that would reduce automobile emissions by thirty percent by 2016.[172] The ruling gave California the right to enforce regulations that exceeded federal clean-air regulations and limited greenhouse gas emissions, but only if the EPA granted a waiver request California had filed two years earlier.[173] However, the following week the EPA denied California's request for a waiver.[174] In denying the request, the EPA Administrator admitted that "greenhouse gas emissions harm the environment" and "[g]reenhouse gases contribute to the problem of global climate change, a problem that poses challenges for the entire nation and indeed the world."[175] Bowing to pressure to release findings that supported the denial, the Administrator released a detailed report that, inter alia, acknowledged:

> According to the comments, along with exacerbating ozone impacts and increasing wildfires, there are a number of other compelling and extraordinary circumstances in California that justify the passage of GHG emission standards, including: declining snowpack and early snowmelt and resultant impacts on water storage and release, sea level rise, salt water intrusion, and adverse impacts to agriculture (e.g., declining yields, increased pests, etc.), forests, and wildlife. . . .
>
> . . . .
>
> California is expected to experience many of the key risks and impacts from climate change that have been highlighted above . . . .
>
> . . . .
>
> In my judgment, the impacts of global climate change in California, compared to the rest of the nation as whole, are not sufficiently

170. Massachusetts v. EPA, 549 U.S. 497, 528 (2007).

171. *Id.* at 533.

172. Cent. Valley Chrysler-Jeep, Inc., v. Goldstone, No. CV F 04-6663 AWI LJO, at 1–2 (E.D. Cal. Dec. 11, 2007) (granting summary judgment for defendants).

173. *Id.* at 56–57. Section 209(b) of the Clean Air Act allows California to request a waiver of the general federal preemption over the control of emission from new engines. *See* 42 U.S.C. § 7543(b) (requiring Administrator to grant waiver to any state that adopted emissions control standards prior to March 30, 1966, subject to certain conditions).

174. Letter from Stephen L. Johnson, EPA Administrator, to Arnold Schwarzenegger, Governor of California (Dec. 19, 2007), *available at* http://www.epa.gov/otaq/climate/20071219-slj.pdf [hereinafter EPA Denial].

175. *Id.*

different to be considered "compelling and extraordinary conditions" that merit separate state GHG standards for new motor vehicles.[176]

The EPA's express acknowledgement that greenhouse gases contribute to climate change and its associated impacts shows that the EPA believes such emissions endanger public health and the environment. Moreover, the EPA's admission that the Bush administration's energy policy adequately addressed the problem of greenhouse gas emissions demonstrates that the EPA believes that it has the present ability and obligation to control OGV emissions.[177]

C. The EPA's Regulatory Response

In 1994, the EPA announced that emissions of CO, NO_X, and VOC from nonroad engines (including engines used on OGVs) and nonroad vehicles contributed significantly to ozone or CO levels in more than one nonattainment area.[178] Thereafter, pursuant to its mandate under section 213 of the CAA, the EPA proposed regulations directed to these sources that included marine diesel engines.[179] The EPA initially proposed to include large marine diesel engines used on OGVs under the same stringent regulatory framework applied to land-based diesel engines due to the similarities between the engines.[180] However, after several maritime nations adopted Annex VI of MARPOL in 1997, the EPA backtracked and announced that it intended to promulgate emissions standards for OGV engines equivalent to those set by Annex VI.[181] Unlike the EPA's land-based diesel engine regulations, however, Annex VI set no limits for hydrocarbons ("HC"), CO, CO_2, or PM. Moreover, emission limits for NO_x under Annex VI were as much as five times higher than land-based standards,[182] and the limit for sulfur content in fuels used by OGVs was a staggering 3,000 times higher than that found in fuels used in land-based diesel engines.[183]

The EPA announced that it planned to adopt the weaker Annex VI standards because OGV emissions made only a "minimal contribution" to U.S.

176. California State Motor Vehicle Pollution Control Standards, 73 Fed. Reg. 12,156, 12,164, 12,167, 12,168 (Mar. 6, 2008).

177. *See* EPA Denial, *supra* note 174 (asserting that Energy Independence and Security Act, which imposed mandatory gas mileage standards for new cars, would address greenhouse gases on national level).

178. Control of Air Pollution: Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts, 59 Fed. Reg. 31,306, 31,306–08 (June 17, 1994) [hereinafter EPA Engine I].

179. Emission Standards for New Gasoline Spark-Ignition and Diesel Compression-Ignition Marine Engines, 59 Fed. Reg. 55,930, 55,930 (Nov. 9, 1994).

180. *Id.* at 55,932.

181. Control of Emissions of Air Pollution from New CI Marine Engines at or Above 37 Kilowatts, 63 Fed. Reg. 28,309, 28,309 (May 22, 1998) [hereinafter EPA Engine II].

182. *See* Emission Standards for New Gasoline Spark-Ignition and Diesel Compression-Ignition Marine Engines, 59 Fed. Reg. at 55,932 (noting that proposed land-based NO_x emission standards for diesel compression-ignition marine engines was 9.2 g/kW-hr); IMO NO_x II, *supra* note 80, at 1 (noting that NO_x emissions under Regulation 13 of 1997 Protocol to MARPOL Annex VI cannot exceed $45.0*n^{(-0.2)}$g/kW-hr. during normal operation, where *n* is rated engine speed).

183. IMO NO_x I, *supra* note 11, at 2.

pollution inventories and because the standards were appropriate emission limits based on the "special fuel" used by these engines.[184] Interestingly, the EPA recognized at that time that "because of the nature of their operation, the contribution of these engines to NO_X levels in certain port cities and coastal areas is much higher."[185] The EPA also reasoned that it could not impose stricter regulations on foreign-flagged OGVs, and believed that imposing stricter standards only on U.S. vessels would compromise their competitiveness in the world shipping market.[186] In effect, all OGVs traveling in U.S. waters, regardless of registry, became subject to the weak regulations contained in Annex VI.

In 2003, the EPA issued a final rule on emission standards for OGV engines.[187] The standards only applied to new marine diesel engines installed on vessels flagged or registered in the United States.[188] The standards mirrored those of Annex VI, and became enforceable under U.S. law for new engines built on or after January 1, 2004.[189] The EPA announced at that time that the standards would remain in effect until the EPA promulgated more stringent "Tier 2" emissions standards for NO_x, SO_x, PM, and other pollutants, which the EPA committed to completing no later than April 27, 2007.[190] Importantly, the EPA noted that it would "consider the state of technology that may permit deeper emission reductions and the status of international action for more stringent standards."[191] The EPA also announced that in future rulemaking it would consider applying the Tier 2 standards to foreign-flagged vessels that enter U.S. ports.[192]

In June of 2004, as part of its Clean Air Nonroad Diesel Rule, the EPA finalized new fuel requirements for nonroad diesel engines, including certain marine diesel engines.[193] Under that rule, the sulfur content of fuel used in certain marine diesel engines would be reduced from the then-current level of 3,000 ppm to 500 ppm by 2007, and further reduced to 15 ppm by 2010.[194] According to the EPA, controlling these emissions would prevent 12,000 premature deaths, 8,900 hospitalizations, 15,000 heart attacks, and 200,000 cases of respiratory symptoms in children annually, and recover one million work days lost by 2030.[195] Further, application of the rule was expected to eliminate

184. EPA Engine II, *supra* note 181, at 28,309.

185. *Id.*

186. *Id.* at 28,313.

187. Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder, 68 Fed. Reg. 9746, 9746 (Feb. 23, 2003) [hereinafter EPA Engine III].

188. *Id.*

189. *Id.*

190. *Id.*

191. *Id.*

192. EPA Engine III, *supra* note 187, at 9746; *see also* 40 C.F.R. § 94.8(a)(2)(ii) (2007) (stating EPA will issue second tier for Category 3 engines by December 17, 2009).

193. Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel, 69 Fed. Reg. 38,958, 38,970–78 (June 29, 2004) [hereinafter EPA Engine IV].

194. *Id.* at 38,961–62.

195. *Id.* at 38,961, 38,968.

approximately 738,000 tons of NO_x and 129,000 tons of PM annually.[196] The EPA estimated that by 2030, this program would result in more than eighty billion dollars annually in environmental and public health benefits at a cost of only two billion dollars per year.[197] Despite recognizing the benefit of reducing sulfur content in fuels, however, the EPA elected not to set standards for the heavy, high-sulfur residual fuel used by OGVs.[198]

After promising to act by April 2007, the EPA announced that it intended to delay adoption of any new emissions standards for OGV engines until December 2009 while it continued to negotiate for changes to Annex VI in the international arena.[199] The EPA based its decision to delay rulemaking solely on its need for additional time to assess existing emission control technologies.[200] On March 14, 2008, amidst great media fanfare, the EPA announced a final rule adopting stringent standards that purported to reduce PM emissions by ninety percent and NO_x emissions by eighty percent from engines, including marine engines, covered under the rule.[201] Not surprisingly, the EPA announced that engines used on OGVs were not included in the rule and would be the subject of future rulemaking.[202]

D. International Negotiations and Impact of Proposed Amendments

In April 2007, the EPA submitted its proposal for stringent OGV emission standards to the IMO.[203] The proposal garnered significant support from other nations, but the EPA's effort was undermined by the fact that the United States had still not ratified Annex VI of MARPOL.[204] As a result of inaction by the EPA and Congress, the U.S. contingent to the IMO was not eligible to vote on amendments to Annex VI during the latest meeting.[205] During that meeting, the IMO's Marine Environment Protection Committee ("MEPC") announced that it approved proposed amendments to Annex VI.[206] The proposed changes would

196. *Id.* at 38,958, 38,961.

197. *Id.* at 38,958.

198. *See* BUREAU OF AIR QUALITY, ME. DEP'T OF ENVTL. PROT., REPORT TO THE JOINT STANDING COMMITTEE ON NATURAL RESOURCES: AIR EMISSIONS FROM MARINE VESSELS 12 (2005), *available at* http://www.maine.gov/dep/blwq/topic/vessel/airemissionsreport.pdf (discussing EPA residual fuel standards).

199. Change in Deadline for Rulemaking to Address the Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder, 72 Fed. Reg. 20,977, 20,978 (Apr. 27, 2007).

200. *Id.*

201. EPA, EPA420-F-08-004, EPA FINALIZES MORE STRINGENT EMISSIONS STANDARDS FOR LOCOMOTIVES AND MARINE COMPRESSION-IGNITION ENGINES 1 (2008), *available at* http://www.epa.gov/otaq/regs/nonroad/420f08004.pdf.

202. *Id.* at 3.

203. *See S. Hearing*, *supra* note 101, at 2 (discussing EPA's efforts to reduce emissions from marine vessels).

204. *Id.* at 4.

205. *Id.*

206. *See* IMO Environment, *supra* note 158 (discussing IMO approval of revised regulations for ship emissions).

reduce the sulfur content of fuels used in OGVs from 4.5% to 3.5% starting January 1, 2012, then progressively to 0.5% effective from January 1, 2020, subject to a feasibility review to be completed by 2018.[207] The sulfur limits applicable in Sulphur Emission Control Areas would be reduced from the existing 1.50% to 1.0% beginning on March 1, 2010, then progressively to 0.10% effective from January 1, 2015.[208]

Under the proposed amendments, more stringent Tier 2 NO_x emission standards would apply to engines installed on ships constructed on or after January 1, 2011.[209] The most stringent Tier 3 standards would apply to engines installed on ships built on or after January 1, 2016.[210] The proposed amendments also allow member nations to designate SO_x, NO_x, or PM emission control areas when "supported by a demonstrated need to prevent, reduce and control one or all three of those emissions from ships."[211] The MEPC also endorsed a proposal to expedite work on greenhouse gas emissions.[212]

While the proposed amendments to Annex VI represent progress, they fail to adequately address the significant health and environmental harm caused by OGV emissions. On average, each day a single OGV releases an amount of harmful pollutants equivalent to that released from 12,000 cars.[213] As ship size continues to increase to accommodate the increased demand for trade and travel, per-vessel emissions will increase. The proposed regulations effectively maintain the status quo for emissions in the short term, needlessly subjecting countless individuals to harmful exposure to toxic emissions and causing further damage to the environment.

MEPC's proposal to reduce the sulfur content of fuels used in OGVs from 4.5% to 3.5%, and then progressively to 0.5% "if feasible," effectively retains the status quo in several ways. First, although Annex VI allows ships to utilize fuels containing a sulfur content of 4.5%, that limit is almost twice the average sulfur content of fuels used by most ships today.[214] In 2006, the average sulfur content

207. *Id.*

208. *Id.*

209. *Id.*

210. *Id.*

> For Tier III, NOx emission levels for a diesel engine which is installed on a ship constructed on or after 1 January 2016 would be reduced to 3.4 g/kWh, when the ship is operating in a designated Emission Control Area. Outside a designated Emission Control Area, Tier II limits apply.

IMO Environment, *supra* note 158.

211. *Id.*

212. *Id.*

213. Dan Weikel, *Shipper to Test System to Cut Emissions*, L.A. TIMES, Dec. 5, 2006, at B-4, *available at* http://articles.latimes.com/2006/dec/05/local/me-ships5; *see also* JENNIFER STANLEY, OFFICE OF THE LEGISLATIVE ANALYST, CITY & COUNTY OF S.F. BD. OF SUPERVISORS, OLA 001-03, CRUISE SHIP TERMINAL AT PIERS 30 AND 32 (REPORT II) (2003), *available at* http://www.sfgov.org/site/bdsupvrs_page.asp?id=18360 (noting single cruise ship in port emits same pollution into atmosphere as 12,240 cars).

214. ICCT, *supra* note 2, at 9.

of fuels used in international shipping was 2.59%.[215] Thus, the proposed amendment will not require OGVs to use fuels that are any cleaner than that already being used. In fact, in view of the dramatic rise in fuel costs worldwide, the proposed amendment provides a direct incentive for the industry to purchase less expensive, dirtier fuel than it is currently using. Further, because the volume of PM emitted is directly related to the quality of the fuel burned, the proposed amendment will have no affect on PM emissions or its associated BC. Second, the proposal to progressively reduce the sulfur content of fuels to 0.50%, "if feasible," provides a direct incentive to the industry to delay developing technology that would make such a change feasible, particularly in view of the high cost associated with making the change. Moreover, the proposal does not begin to phase in until the results of a study to be completed no later than 2018 are released. Even if that study demonstrates that further sulfur reduction is feasible, under the proposed amendment the industry is allowed to continue emitting at its current level until the study is completed. While MEPC's proposed reductions in sulfur emissions for vessels traveling within designated Sulphur Emission Control Areas is promising, only two SECAs currently exist and neither covers U.S. waters.[216]

MEPC's proposed amendment on sulfur emissions will have almost no impact on current SO_x emissions from OGVs, and therefore does not allow for the type of immediate response needed to protect humans and the environment from the harmful effects of SO_x emissions. Therefore, additional action by the EPA is warranted.

MEPC's proposal regarding NO_x emissions is equally problematic. MEPC agreed to a three-tier regulatory structure for new engines, which becomes progressively tighter depending on the date an engine is installed on a newly constructed ship. Tier 1 standards apply to engines installed on ships constructed prior to January 2011, and mirror the existing standards under Annex I.[217] More stringent Tier 2 standards apply to engines installed on ships "constructed on or after" January 1, 2011.[218] The most stringent standards—Tier 3—apply to engines installed on ships "constructed on or after" January 1, 2016.[219]

While the proposed standards will eventually reduce the amount of harmful NO_x released into the atmosphere, it will take decades to observe a noticeable decrease from current values. This is because Tier 2 and Tier 3 standards will not apply to any vessel constructed prior to January 2011. Given that the average age of an OGV in 2006 was 11.2 years, with a life expectancy of 32.6 years,[220] under the proposed amendment the existing OGV fleet could continue to emit NO_x at

215. IMO, *Marine Environment Protection Committee Progresses Key Issues*, IMO NEWS, Issue 3 2007, at 20, 21, *available at* http://www.imo.org/includes/blastData.asp/doc_id=8520/IMO_News_No3_07_LOW.pdf.

216. IMO Environment, *supra* note 158.

217. *Id.*

218. *Id.*

219. *Id.*

220. *See* DOT II, *supra* note 106, at 4 (describing vessels at U.S. ports); *see also* MIKELIS, *supra* note 135, at tbl.3 (discussing ship age and recycling).

its current level with impunity for the next two decades. Thus, the proposed amendment does not provide for the type of immediate response needed to protect humans and the environment from the harmful effects of NO_x. Therefore, EPA action is warranted.

MEPC endorsed a proposal to "expedite" work on establishing a regulatory framework on greenhouse gas emissions, which includes the development of a CO_2 Emissions Indexing Scheme and a CO_2 Emission Baseline.[221] However, MEPC did not establish a timeline for implementation of either plan.[222] Thus, for the immediate future the status quo was maintained. The failure to implement greenhouse gas emission standards for OGVs is startling in view of the rapidly developing consensus that emissions-induced climate change poses the most significant threat to humans and the environment of this era.[223]

In the short term, the proposed amendments to Annex VI will do nothing to protect the environment and the hundreds of thousands of people impacted each year by harmful diesel emissions. When the proposed regulations begin to phase in they will only apply to newly constructed vessels. As a result, thousands of OGVs will escape regulation and continue to pollute U.S. skies as usual. After recently touting the enormous health and environmental benefits that will result from its domestic regulation of smaller marine and land-based diesel engines, inconceivably the EPA has acquiesced in an international plan to press a regulatory "snooze button" that allows the shipping industry time to adapt to its own negative externalities.

Despite knowing that marine diesel emissions are carcinogenic, cause or contribute to a number of human illnesses, and cause significant damage to the environment, the EPA has failed to act.[224] For more than a decade, the EPA has sat idle as an industry composed primarily of foreign-flagged vessels emitted massive quantities of toxins into the air at the expense of American lives and the environment.[225] More troubling perhaps is the recent suggestion that the EPA repeatedly ignored its own studies while it waited for an international body to

221. IMO Environment, *supra* note 158.

222. *Id.*

223. *See, e.g.*, EPA Denial, *supra* note 173 (referring to emissions-based climate change as worldwide problem); NAT'L ACAD. OF SCI. ET AL., JOINT SCIENCE ACADEMIES' STATEMENT ON GROWTH AND RESPONSIBILITY: SUSTAINABILITY, ENERGY EFFICIENCY AND CLIMATE PROTECTION 1 (2007), http://www.leopoldina-halle.de/energy-climate.pdf (presenting view of international group of scientists that global warming is significant threat to human life); UNION OF CONCERNED SCIENTISTS, U.S. SCIENTISTS AND ECONOMISTS' CALL FOR SWIFT AND DEEP CUTS IN GREENHOUSE GAS EMISSIONS (2008), http://www.ucsusa.org/assets/documents/global_warming/Scientist_Economists_Call_to_Action_fnl.pdf (listing 1,733 scientists and economists who endorse reducing U.S. emissions to below 2000 levels because of the "strength of the science on climate change").

224. *See* EPA, *supra* note 16, at 2-1 to 2-3 (acknowledging that emissions from diesel trains and boats are "associated with serious public health problems" and cause "harmful environmental impacts"). See *supra* Part II for a discussion of the negative health effects of OGV emissions.

225. Overwhelmingly, OGV emissions in U.S. waters originate from ships registered in foreign nations. Approximately eighty-nine percent of all commercial OGVs that called on U.S. ports in 2006 were foreign–flagged. *See* DOT II, *supra* note 106, at 2, 7 (describing vessel calls at U.S. ports).

provide a solution to a national problem.[226] The EPA's blind deference to the IMO has allowed foreign interests to dictate domestic air pollution policy on marine emissions. In the process, the EPA has impermissibly elevated the interests of industry over the interests of the individuals and environment it is charged with protecting. As a result of the EPA's inaction, the environment will be subjected to further degradation while untold numbers of individuals face unnecessary exposure to harmful toxins.

V. RECOMMENDATIONS

The EPA has known for more than a decade that OGV emissions significantly contribute to pollution inventories in port and coastal states, and pose significant health and environmental risks. Despite this knowledge, the EPA continues to defer to an international body dominated by major maritime nations that have little incentive to improve vessel emissions. The EPA's failure to implement stringent emissions standards for OGVs traveling in U.S. waters directly conflicts with its mandate under the CAA to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare."[227] The EPA's regulatory foot dragging with regard to OGV emissions makes little sense in view of the stringent standards it recently promulgated for smaller marine diesel engines, standards the EPA acknowledges will provide significant health and environmental benefits at marginal cost. The EPA should be compelled to immediately promulgate emissions standards for all OGVs, regardless of country of registry, comparable to existing standards applied to other nonroad marine diesel engines. Such regulations must include standards for greenhouse gas emissions.

A. The EPA Must Exercise Its Nondiscretionary Duty to Regulate OGV Emissions

Section 213 of the CAA requires the EPA to promulgate emissions standards for nonroad engines and nonroad vehicles if emissions from such engines significantly contribute to ozone or CO in more than one nonattainment area.[228] The EPA made this determination in 1994. At that time, the EPA announced that it would promulgate standards for CO, HC, PM, NO_x, and smoke emissions from "large nonroad compression-ignition (CI) engines at or above 37 kilowatts (kW) in power," which includes OGV engines.[229] The fact that the EPA later determined that it might be too difficult to impose stringent emissions standards on a fleet primarily composed of ships registered in other

226. *See* Press Release, Union of Concerned Scientists, Hundreds of EPA Scientists Report Political Interference over Last Five Years (Apr. 23, 2008), http://www.ucsusa.org/news/press_release/hundreds-of-epa-scientists-0112.html (reporting results of survey of EPA scientists revealing public statements made by EPA officials that misrepresent scientists' findings, and selective use of study facts to support political agenda).

227. 42 U.S.C. § 7401(b)(1) (2006).

228. *Id.* § 7547.

229. EPA Engine I, *supra* note 178, at 31,306.

countries does not relieve the EPA of its duty to fulfill its mandate under the CAA. Moreover, the EPA's decision to adopt Annex VI standards and recent acquiescence to proposed amendments thereto does not satisfy its obligation to promulgate emission standards under section 213.

To regulate OGV emissions, the EPA necessarily would be required to regulate the sulfur content of fuels used in OGV engines. The EPA initially chose to adopt weak standards contained in Annex VI, with the hope of working in the international arena toward a more sustainable emission level. While the EPA's initial inaction might be understandable in view of the poor understanding of the harm caused by vessel emissions, its current inaction constitutes a complete dereliction of duty. By acquiescing in a proposal to amend Annex VI that will provide almost no change in future sulfur emission levels, the EPA impermissibly ignored its duty to protect human health and the environment from harm.

When the EPA initially adopted the Annex VI standards, the agency acknowledged that the NO_x limits were "so close to average uncontrolled emission levels" that the contribution to global NO_x levels was "not expected to be greatly reduced."[230] Despite this view, the EPA adopted the standards in lieu of promulgating more stringent standards. Now, the EPA has agreed to a proposal to amend Annex VI that effectively permits all existing OGVs to avoid the more stringent emissions limits and to continue to pollute at current levels. The EPA's position is unreasonable in view of the documented harm already sustained as a result of emission of NO_x at current levels.

Because Annex VI does not address CO, CO_2, HC, or PM, the EPA's decision to adopt the regulations contained therein accomplished nothing with regard to these pollutants. Moreover, by electing to adopt emission standards identical to those contained in Annex VI, the EPA maintained the status quo and failed to "consider standards equivalent in stringency to standards for comparable motor vehicles or engines" as required under section 213 of the CAA.[231] Although the EPA retains discretion to determine whether the regulations promulgated meet the requirements of section 213, based on the EPA's proposed amendments to Annex VI, it is clear that the EPA believes that the existing emission standards for these pollutants are inadequate.[232]

The proposed amendments to Annex VI adopted by MEPC will do nothing to limit OGV emissions in the near term, and will provide only marginal benefits over the next several decades. Therefore, the EPA should be required to promulgate meaningful emissions standards for OGV engines consistent with the mandates of the CAA that result in measurable reductions in harmful OGV emissions.

230. IMO Tier 2, *supra* note 9, at 4.

231. 42 U.S.C. § 7547(a)(3).

232. *See, e.g.*, Mision Indus., Inc. v. EPA, 547 F.2d 123, 129 (1st Cir. 1976) (noting that determination of whether ambient air quality standards are being met is infused with discretion).

B. The EPA Should Regulate OGV Emissions That Contribute to Global Climate Change

Since the dawn of the industrial revolution, heat-trapping gases have accumulated in the atmosphere as a result of the combustion of fossil fuels and other human activity.[233] Over the last century, the build-up of these gases has contributed to a warming of the atmosphere, land, and oceans.[234] Human society and the environment are sensitive to climate variability and change.[235] Although the future impact of these changes is difficult to accurately predict, a scientific consensus exists that global warming will likely cause sea levels to rise, glaciers to melt, disruptions in agricultural production, extreme weather events, expansion of tropical diseases, alterations in seasonal patterns within ecosystems, dramatic economic impacts, and civil unrest in many areas of the world.[236] Left unchecked, global warming has the potential to cause irreversible changes to, or the complete eradication of, ecosystems on a global scale.[237]

The largest increase in temperature has occurred over the last two decades, prompting scientists worldwide to call for immediate regulatory action aimed at reducing the emission of heat-trapping greenhouse gases.[238] Despite this action, global temperatures continue to rise as human activities add more CO_2, CH_4, N_2O, and other heat-trapping gases to the atmosphere.[239] North America, for example, is expected to warm between 3.6°F and 18°F (between 2°C and 10°C) by 2100 as a result of the accumulation of these gases in the atmosphere.[240] This temperature increase in the United States is expected to result in a myriad of regional changes, including an increase in heat-related morbidity and mortality, increased coastal erosion, loss of wetland habitat, increased risk from storm surges from sea level rise, shifts in the ranges of plant and animal species, lowered lake and river levels, and northward agricultural productivity shifts.[241] Moreover, this change in climate is anticipated to negatively impact human

233. IPCC, *Climate Change 2007*, *supra* note 59, at 2.

234. *Id.* at 5.

235. See *supra* Part II.D for a discussion of the effects of climate change.

236. IPCC, *Climate Change 2007 - Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Fourth Assessment Report of the IPCC*, at 9 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf.

237. *See generally* IPCC, *Climate Change and Biodiversity: IPCC Technical Paper V* (2002), *available at* http://www.ipcc.ch/pdf/technical-papers/climate-changes-biodiversity-en.pdf [hereinafter IPCC Biodiversity] (discussing climate change and effects on biodiversity).

238. In 1994, the United Nations Framework Convention on Climate Change ("UNFCCC") established a framework for intergovernmental efforts to address the problems associated with climate change. The United Nations Framework Convention on Climate Change, http://unfccc.int/essential_background/convention/items/2627.php (last visited May 26, 2009).

239. EPA, Future Climate Change, http://www.epa.gov/climatechange/science/futurecc.html (last visited May 26, 2009) [hereinafter EPA Climate Change III].

240. EPA, U.S. Regions, http://www.epa.gov/climatechange/effects/usregions.html (last visited May 26, 2009) [hereinafter EPA Climate Change IV].

241. *Id.*

health as a result of changes in water, air, food quality and quantity, ecosystems, agriculture, and economy.[242]

OGVs emit CO_2, N_2O, and CH_4, all of which the EPA has identified as significant heat-trapping gases that contribute to climate change.[243] The EPA has also determined that these gases play a significant role in global warming.[244] Although the EPA has not determined the impact of BC on global warming, studies show that the impact is significant.[245] The Administrator is authorized under section 213 of the CAA to regulate these emissions because he has already found that they significantly contribute to air pollution that "may reasonably be anticipated to endanger public health or welfare."[246] Thus, the Administrator should be required to promulgate regulations to reduce greenhouse gas emissions from OGVs.[247]

C. The EPA Should Regulate the Sale of Low-Sulfur Fuels in U.S. Ports to Control OGV Emissions

Today, approximately ninety percent of the world's trading fleet runs on high-sulfur residual fuels.[248] To successfully reduce SO_x, NO_x, and PM (and its associated BC) emissions, the EPA must reduce the sulfur content in fuels used by OGVs. There is no logical reason to exclude OGVs from the stringent fuel standards currently applied to smaller marine engines and other vehicles. Allowing OGVs to continue using high-sulfur fuels while other motor vehicles are required to use cleaner fuels will minimize any benefit the EPA hopes to achieve through application of its existing fuel standards.

242. EPA, Health and Environmental Effects, http://epa.gov/climatechange/effects/health.html (last visited May 26, 2009) [hereinafter EPA Climate Change V].

243. EPA Climate Change I, *supra* note 60; IPCC Biodiversity, *supra* note 237, at 4–7.

244. EPA, EPA 430-R-08-005, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2006, at ES-9 (2008), *available at* http://www.epa.gov/climatechange/emissions/downloads/08_CR.pdf; EPA Climate Change V, *supra* note 242.

245. Veerabhadran Ramanathan, *Global Warming*, BULL. AM. ACAD. ARTS & SCI., Spring 2006, at 36, 37 (noting "[b]lack carbon is probably the most insidious component of the haze as far as health is concerned; it is also the most important factor in terms of climate change"); *see also* SIEGEL ET AL., *supra* note 92, at 1–5 (discussing polar bears and effects of arctic meltdown).

246. Section 213(a)(4) of the CAA provides that

> [i]f the Administrator determines that any emissions not referred to in paragraph (2) from new nonroad engines or vehicles significantly contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, the Administrator may promulgate . . . such regulations as the Administrator deems appropriate containing standards applicable to emissions from those classes or categories of new nonroad engines and new nonroad vehicles . . . which in the Administrator's judgment cause, or contribute to, such air pollution.

42 U.S.C. § 7547(a)(4) (2006).

247. Massachusetts v. EPA, 549 U.S. 497, 533 (2007) (noting "[i]f EPA makes a finding of endangerment, the Clean Air Act requires the agency to regulate emissions of the deleterious pollutant from new motor vehicles").

248. Luke Pachymuthu & Yaw Yan Chong, *Tanker Owners Join Call for Ship Switch to Diesel*, REUTERS, Apr. 4, 2007, http://www.reuters.com/article/basicindustries-SP-A/idUSSP18474220070404.

There are multiple benefits to regulating the manufacture and sale of fuels used by OGVs that make this an ideal option. First, the EPA has clear authority to regulate the manufacture and sale of marine fuels. As recently noted in *Pacific Merchant Shipping Ass'n v. Cackette*,[249] regulations that merely govern fuel quality characteristics are permissible under section 211 of the CAA.[250] If the EPA elects to regulate fuel quality, the regulations would instantly apply to all vessels taking on fuel while in U.S. ports, regardless of country of registry. This is because imposing fuel standards does not run afoul of the international mandate that state regulations imposed against foreign vessels not impede innocent passage or impact the construction, design, equipment, or manning of the ship.[251] Moreover, maritime nations appear willing to accept such a plan. Recently, the World Shipping Council, which represents ninety percent of the world's shipping fleet, endorsed a plan that would require the use of cleaner fuels near sensitive ports while allowing conventional sulfur-rich bunker fuel far from shore.[252]

The primary impediment to a switch to cleaner fuels is the high price of low-sulfur fuels. According to some estimates, converting to low-sulfur distillate fuel would cost the industry $126 billion and increase marine fuel costs by one-third by 2020.[253] The high cost does not justify EPA inaction, because most of the increased cost of shipping will likely be passed on to the consumer in the cost of goods. As the EPA has already recognized, however, the long-term health and environmental benefits associated with switching to cleaner fuels will more than offset any short-term costs. Despite recognizing that by 2030 its own sulfur reduction fuel program for other smaller diesel engines will result in eighty billion dollars in annual environmental and public health benefits at a cost of only two billion dollars, the EPA has allowed the largest source of marine diesel emissions to escape regulation.[254] The EPA's failure to act to reduce OGV emissions allows a large burden of the real cost of shipping to be shifted from foreign companies to individuals, the American health care system, and the environment.[255] To correct this problem, the EPA should require all U.S. ports to sell fuel that has a sulfur concentration significantly below the average sulfur content found in fuels currently used by the international shipping industry. Doing so will result in immediate reductions in SO_x, NO_x, and PM emissions, because ships refueling in port will be required to load the lower sulfur fuel.

249. No. CIV. S-06-2791 WBS KJM, 2007 WL 2492681 (E.D. Cal. Aug. 30, 2007).

250. *Pac. Merch. Shipping Ass'n*, 2007 WL 2492681, at *9.

251. ICCT, *supra* note 2.

252. Jack Peckham, *'Category 3' Ocean Ship Diesel Emissions Rule Delayed; IMO Talks Dragging On*: *U.S. EPA*, DIESEL FUEL NEWS, Mar. 12, 2007.

253. David Osler, *Switch to Distillate Fuel 'Could Cost Up To $67bn*,' LLOYD'S LIST, Sept. 21, 2007, *available at* http://www.lloydslist.com/ll/news/viewArticle.htm?articleId=1190019537414.

254. *See* EPA Engine III, *supra* note 187 (discussing control of emissions from new marine engines).

255. Although no data exist on the actual societal costs of OGV emissions, the EPA's estimate of savings anticipated to result from controlling emissions from smaller diesel engines suggests that the monetized health and environmental costs associated with exposure to OGV emissions is substantial.

Switching to cleaner fuels has the added advantage of allowing the EPA to regulate fuel use in thousands of ships currently in operation that would not be covered if the EPA established emission regulations for OGVs. This is because any emission regulation promulgated pursuant to a finding of harm under section 213 of the CAA would only apply to new engines.[256] By controlling the type of fuel available for purchase in U.S. ports, the EPA could indirectly control the quality of emissions from most OGVs transiting U.S. waters without interfering with the construction, design, equipment, or manning of the ship.[257]

D. The EPA Should Establish National Emission Control Areas

Now that Congress has adopted Annex VI of MARPOL, the EPA should immediately petition the IMO for the establishment of a national Sulfur Emission Control Area that covers the entire U.S. seaboard. In view of the rapid expansion of ports in the United States, the transboundary migration of vessel emissions, the significant impact diesel emissions continue to have on marine and coastal environments, and the significant contribution of foreign-flagged ships to U.S. pollution inventories, such a petition is both reasonable and necessary. Establishment of a national SECA would immediately require all ships, regardless of registry, to switch to low-sulfur fuels while traveling in U.S. waters, or employ other on-board technology that limits sulfur emissions.[258] This would result in a significant reduction in SO_x, NO_x, and PM emissions, and improve air quality for those living in the coastal zone. Moreover, a SECA would be more effective than simply regulating fuel quality in port because the overall benefit from regulating the sale of fuel is dependent on ships refueling while in U.S. ports. Because some ships will opt to refuel in foreign ports, a national SECA will ensure that all ships will use cleaner burning fuels while transiting U.S. waters.

If MEPC's proposed amendments to Annex VI are adopted, member nations will be allowed to designate emission control areas for SO_x, NO_x, and PM "if supported by a demonstrated need to prevent, reduce and control one or all three of those emissions from ships."[259] In the event the proposed amendments are accepted and the EPA has not yet promulgated standards for the emission of these pollutants, the EPA should immediately petition the IMO for the designation of a national emission control area that covers all three pollutants. Scientific studies unequivocally demonstrate how these emissions cause, and will to continue to cause, harm to U.S. citizens and the environment. Given the anticipated increase in global trade and cruising, and the impact this will have on the United States, such a petition is both reasonable and necessary.

256. 42 U.S.C. § 7547(a)(4) (2006).

257. *See* ICCT, *supra* note 2, at 5–12 (discussing options for mitigation of air pollution by OGVs).

258. *See* MARPOL Annex VI, *supra* note 153, at 4 (discussing emission standards proposal for defined coastal areas, including United States).

259. *See* IMO Environment, *supra* note 158 (discussing MEPC approval of revised ship emission regulations).

VI. CONCLUSION

A single OGV engine is large enough that if it were based on land it would be considered a major source of pollution and be subject to mandatory emissions controls under the CAA. Each day, thousands of OGVs transit U.S. waters and enter ports while emitting enormous quantities of harmful pollutants. For more than a decade the EPA has understood the significant negative impact that OGV emissions have on U.S. air quality. Rather than act to reduce the harm caused to human health and the environment from these emissions, the EPA has sought an international solution to a national problem. Despite recognizing that the cost of regulating diesel emissions is far less than the potential benefit that could be gained, the EPA continues to allow the largest sources of marine diesel emissions to spew unchecked quantities of harmful toxins into the air. The time has come for the EPA to step away from the international table and focus on fulfilling its mandate to protect human health and the environment at home.