**Alaska Wilderness League * Audubon Alaska *
Center for Biological Diversity * Defenders of Wildlife * Earthjustice *
Friends of the Earth * Indigenous Environmental Network * Pacific Environment *
Resisting Environmental Destruction on Indigenous Lands**

March 27, 2009

VIA EMAIL and CERTIFIED MAIL

Honorable Lisa Jackson
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U.S. Environmental Protection Agency
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U.S. Environmental Protection Agency
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RE: Inclusion of Alaska in EPA's Application to IMO for a North American Emission Control Area

Dear Administrator Jackson and Mr. Bunker:

In accordance with the 2008 amendments to Annex VI of the MARPOL treaty, the US Environmental Protection Agency (EPA) is preparing an application to the International Maritime Organization (IMO) to have US coastal waters designated as an Emissions Control Area (ECA). It is our understanding that the application will only include the coastlines of the contiguous 48 states and the Pacific coast of Alaska along the southern coast of the peninsula, but will not include Alaska's Arctic waters. The undersigned strongly urge EPA to include all Alaskan waters in its application to the IMO to designate a North American ECA extending 200 nautical miles from the coast. If it is not possible to include Alaska in the application before the April 2009 submission date, we urge EPA to amend its application before it is voted on by the IMO.

As EPA is aware, emissions of nitrogen oxides (NOx), sulfur oxides (SOx) and particulate matter (PM) from ocean-going vessels have significant detrimental impacts on human health and the environment in Alaska, as they do elsewhere in the United States. In addition to these impacts, including Alaskan waters in the North American ECA is particularly important because of the climate impacts of emissions from ocean-going vessels in these waters. Because

NOx is a precursor of tropospheric (ground-level) ozone, the NOx reductions required within ECAs would result in significant reductions of this greenhouse gas. Moreover, because tropospheric ozone is short-lived in the atmosphere it has more localized climate impacts.[1] Shipping emissions in the Arctic have the potential to increase Arctic ozone by a factor of 2 to 3 relative to the present day.[2] Thus reducing NOx emissions in Alaskan waters will reduce local ozone formation and help to slow climate warming and the associated impacts in the Alaskan Arctic.

Including Alaska in the ECA would also require ships in Alaskan waters to use low sulfur fuel, which is a prerequisite for the implementation of the most efficient diesel particle traps that reduce black carbon, the second most powerful climate warming agent after carbon dioxide. As described in more detail below, it is particularly import to reduce emissions of black carbon in Alaskan waters because of the effects of deposition of local emissions of black carbon on ice and snow in the Arctic.

I. Climate Warming Pollutants in Alaska

The Arctic, including Alaska, has warmed at twice the rate of the rest of the world over the past century.[3] While most of this warming is likely due to rising global levels of carbon dioxide, up to half the observed warming may be due to short-lived climate pollutants including black carbon and tropospheric ozone.[4] Because these pollutants are not well-mixed globally, reducing local emissions is crucial for reducing regional climate warming.[5] Slowing Arctic warming is essential to averting some of the most severe global impacts of climate change and avoiding potentially catastrophic tipping points including permafrost melt, glacier melt and resulting sea level rise. Reduction of the short-term climate forcers ozone and black carbon in Alaska through implementation of the stringent standards applicable in Emissions Control Areas can effectively buy some time for the extraordinary cultures, biodiversity and ecosystems of Alaska to adapt to warming that will continue to occur as a result of past and future emissions of longer-lived greenhouse gases.

II. The ECA Standards Will Reduce the Impacts of Climate Warming in Alaska

a. NOx and Tropospheric Ozone

Nitric oxide and nitrogen dioxide, together termed oxides of nitrogen or NO_x, are precursors of tropospheric (ground-level) ozone, which acts a greenhouse gas, absorbing some of the infrared energy emitted by the earth. Ozone is an optically active gas that absorbs and emits terrestrial infrared radiation in the 8 to 10 micrometer region and absorbs solar radiation in the

[1] Quinn, P. et al., *Short-lived Pollutants in the Arctic: Their Climate Impact and Possible Mitigation Strategies*, Atmos. Chem. Phy., 8, 1723-35, 2008.
[2] *Id.* at 1725.
[3] IPCC 2007, Observations: Surface and Atmospheric Climate Change, In: *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report,* [Trenberth, K. et al, (eds.)], available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter3.pdf at 237.
[4] Quinn et al. 2008, *supra* note 1. Three short-lived climate forcers – black carbon, tropospheric ozone and methane – are thought to account for up to one half of observed Arctic climate warming.
[5] *Id*.

UV and visible spectrum.[6] A change in ozone concentrations perturbs the radiative energy budget of the Earth-atmosphere system, which in turn perturbs the climate.[7] The majority of tropospheric ozone formation occurs when NOx, carbon monoxide (CO) and volatile organic compounds (VOCs), such as xylene, react in the atmosphere in the presence of sunlight. Thus NOx, CO, and VOCs are ozone precursors. Tropospheric ozone changes contribute a climate forcing of +0.35 [+0.25 to +0.65] Watts per meter square (W/m^2), or about 21% of the radiative forcing of carbon dioxide.[8]

b. Black Carbon

Black carbon is the light-absorbing, carbonaceous component of soot.[9] It is an aerosol and combustion by-product of inefficient burning of fossil fuels, biofuels, and biomass.[10] It is released as fine particulate matter into the troposphere,[11] and from there can move into the stratosphere.[12] The direct climate forcing effect of black carbon occurs when the particles absorb sunlight and release that energy as heat into the atmosphere. The current estimate for black carbon forcing at the "top of the atmosphere" is as much as 60% of the current radiative forcing due to carbon dioxide's greenhouse gas effect.[13] It is now thought to be the second most powerful contributor to global warming after carbon dioxide,[14] and it adds two to three orders of magnitude more energy to the climate system than an equivalent mass of CO_2.[15] Black carbon has a combined radiative forcing (from interception of direct and reflected sunlight, deposition on ice and snow, and evaporation of low clouds) of 1 to 1.2 Wm^{-2} (+/- 0.4 Wm^{-2}).[16]

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[6] Fishman, J., V. Ramanathan, P. Crutzen & S. C. Liu, *Tropospheric Ozone and Climate*, Nature, vol. 282, 20/27 December 1979.

[7] *Id*.

[8] IPCC, 2007: Summary for Policymakers, In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. available at: http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf, at 4.

[9] Lack, D., et al., *Light Absorbing Carbon Emissions from Commercial Shipping*, Geophysical Research Letters, vol. 35, 2008.

[10] Ramanathan, V. and G. Carmichael, *Global and Regional Changes Due to Black Carbon*, Nature Geoscience, vol. 1, 2008.

[11] The troposphere extends from earth's surface to 6-10 miles (10-16) kilometers, to the boundary with the stratosphere, where temperatures no longer drop and the air is almost completely dry, and "weather" no longer occurs.

[12] Pueschel, R. F., et al., *Soot Aerosol in the Lower Stratosphere: Pole to Pole Variability and Contributions by Aircraft*, J. Geophys. Res., 1997.

[13] Ramanathan, V., *Role of Black Carbon on Global and Regional Climate Change*, Testimony to the House Committee on Oversight and Government Reform Committee, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007.

[14] *Id*.

[15] Bond, T., *Testimony for the Hearing on Black Carbon and Climate Change*, House Committee on Oversight and Government Reform, U.S. House of Representatives, The Honorable Henry A. Waxman, Chair, October 18, 2007. Note also that Dr. Bond's testimony indicates that one kilogram of black carbon, emitted today, adds about 2000 times much energy to the Earth system over 20 years as 1 kg of carbon dioxide.

[16] Ramanathan 2007, *supra* note 13 at 7.

Black carbon is also a potent climate warming agent when deposited on snow and ice,[17] which may be responsible for a quarter of observed global warming.[18] This effect represents a significant fraction of Arctic climate forcing.[19] Black carbon aerosols stay aloft in the atmosphere for an average of only 4.6 days, and rarely more than one week.[20] Once deposited, black carbon reduces the albedo, or reflectivity, of these surfaces, and increases the rate of melting, even when air temperatures are below freezing.[21] In many areas, when these surfaces melt, the darker water or land exposed below absorbs more incoming sunlight, causing additional warming.[22] About half the warming effect of black carbon on snow comes from its dark color; the other half occurs if darker earth or water below snow or ice becomes exposed.[23] This is an example of a positive feedback, where a system responds to a perturbation in the same direction as the perturbation.[24] Recent studies show that this effect of black carbon is much greater than had been previously assumed.[25]

Black carbon is having a significant melting effect on glaciers and sea ice in the Arctic, including the Greenland ice sheet.[26] Over 80 percent of the forcing caused by black carbon on snow comes from black carbon from fossil fuels.[27] As black carbon increases melting on the surfaces of glaciers, the resulting meltwater percolates down through cracks in the ice and may increase lubrication at the bottom of the glacier causing the glacier to flow more quickly.[28] This is another example of positive feedback loop for black carbon's climate impacts, as the downward movement of ice to lower (and warmer) altitudes increases its melt rate.[29] Ice sheets

[17] Quinn et al. 2008, *supra* note 1; *see also* Flanner, M., et al., *Present-Day Climate Forcing and Response from Black Carbon in Snow*, Journal of Geophysical Research, v. 112, 2007; Jacobson, M., *Testimony for the Hearing on Black Carbon and Arctic*, House Committee on Oversight and Government Reform United States House of Representatives, Oct. 18, 2007; and Zender, C., *Arctic Climate Effects of Black Carbon*, Testimony to the House Committee on Oversight and Government Reform Committee, October 18, 2007, at 3.
[18] Hansen, J & L. Nazarenko, *Soot Climate Forcing Via Snow and Ice Albedos*, 101 Proc. Of the Nat'l Acad. Of Sci. 423, January 13 2004.
[19] Zender 2007, *supra* note 18.
[20] Reddy, M. S. and O. Boucher, *Climate Impact of Black Carbon Emitted from Energy Consumption in the World's Regions*, Geophysical Research Letters, 34, L11802, 2007. Note also that while black carbon particles are aloft they are often coated by sulfates, causing them to become larger and thus more absorbing of solar radiation, with stronger atmospheric warming effects. *See* Khalizov, A. et al., *Enhanced Light Absorption and Scattering by Carbon Soot Aerosol Internally Mixed with Sulfuric Acid*, Journal of Physical Chemistry, v. 113 (6), February 24, 2009; *see also* Jacobson, M., *Effects of Externally-Through-Internally Missed Soot Inclusions Within Clouds and Precipitation on Global Climate*, J. Phys. Chem. A, 110, 21, 2006.
[21] Flanner et al. 2007, *supra* note 18.
[22] Streets, D. G., *Dissecting Future Aerosol Emissions: Warming Tendencies and Mitigation Opportunities*, Climatic Change, 81:313–330DOI 10.1007/s10584-006-9112-8 (2007). See also Ramanathan and Carmichael 2008, *supra* note 11; Quinn et al. 2008, *supra* note 1; Zender 2007, *supra* note 18; and Jacobson 2007, *supra* note 18.
[23] Qian, Y., et al., *Effects of Soot-Induced Snow Albedo Change on Snowpack and Hydrological Cycle in Western U.S. Based on WRF Chemistry and Regional Climate Simulations*, Journal of Geophysical Research- Atmospheres, 2009.
[24] Lenton, T.M., et al., *Tipping Elements in the Earth's Climate System*, PNAS, vol. 105, no. 6, February 12, 2008.
[25] Flanner et al. 2007, *supra* note 18.
[26] McConnell, J.R. et al., *20th Century Industrial Black Carbon Emissions Altered Arctic Climate Gorcing*, Science, 317 (5843), 2007*; see also* Reddy, M. S. and O. Boucher 2007, *supra* note 21; *and* Zender 2007, *supra* note 18.
[27] Flanner et al. 2007, *supra* note 18.
[28] Rignot, Eric, *Glaciological Studies of the Evolution of Ice Sheets in a Warming Climate*, Eos. Trans. American Geophysical Union, 89 (53), Fall Meeting Suppl., Abstract, 2008; *see also* Rignot and Kanagaratnam, *Changes in the Velocity Structure of the Greenland Ice Sheet*, Science 311: 986, 2006.
[29] Rignot 2008, *supra* note 29.

calving into the relatively warmer ocean also increase melting.[30] Black carbon deposition increases surface melt on ice masses, and the meltwater spurs multiple radiative and dynamic feedback processes that accelerate ice disintegration.[31] During the Arctic spring, black carbon-contaminated snow absorbs enough extra sunlight to melt earlier – weeks earlier in some places – than clean snow.[32]

Thus, black carbon increases surface melting of snow, atmospheric temperature, and glacial slide to lower elevations, as well as reducing precipitation over affected glaciers.[33] Black carbon on snow in the Cascades and Rocky Mountains for example warms the snow and air above it by up to 1.2 degrees Fahrenheit, resulting in a thinner snowpack that reflects less light, which further warms the area. [34] This causes regional changes to snowpack that result in dirty snow melting weeks earlier in spring than pristine snow.[35]

Black carbon constitutes approximately 15% of the particulate matter emitted from ships,[36] although this percentage changes with engine technology, fuel type, engine temperature, and pollution mitigation technologies.[37] Reducing black carbon emissions from ships is dependent upon switching to ultra-low sulfur fuels, not because the fuel itself emits less black carbon,[38] but because without it the ships cannot use the efficient particle traps on smokestacks.[39] It's critical to note that the use of low-sulfur fuel will *reduce* the emission of SOx and sulfates, which have a net cooling effect on the climate because they scatter, rather than absorb solar radiation.[40] It is thus critical that particle traps to reduce black carbon emissions be mandated in concert with fuel-switching regulations to ensure a net climate cooling result.

III. Shipping Is Expected To Increase in Alaska Due to Reduced Sea Ice

Ship traffic and the resulting emissions of air pollutants in Alaskan waters are anticipated to rise dramatically in the near future as the melting of sea ice opens of the Northwest passage (9000 km shorter than a Panama Canal route between Europe and Asia) and the Northern Sea

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[30] *Id*.
[31] Hansen, J. and L. Nazarenko 2004, *supra* note 19.
[32] Zender 2007, *supra* note 18.
[33] Barnett, T.P., J.C. Adam & D.P. Lettenmaier, *Potential Impacts of a Warming Climate on Water Availability in Snow-Dominated Regions*, Nature, v. 338, 17 November 2005.
[34] Qian, Y. et al., *supra* note 24 at 114.
[35] *Id*.
[36] Lack, D., et al., *Particulate Emissions From Commercial Shipping: Chemical, Physical and Optical Properties*, Journal of Geophysical Research, vol. 114, 2009.
[37] Bond, T. C. et al., *A Technology-Based Global Inventory of Black and Organic Carbon Emissions from Combustion*, Journal of Geophysical Research, vol. 109, D14203, 2004, at 1.
[38] Lack 2009, *supra* note 37.
[39] Manufacturers of Emission Controls Association (MECA), *Emission Control Technologies for Diesel-Powered Vehicles*, 9, December 2007, available at: http://www.meca.org/galleries/default-file/MECA%20Diesel%20White%20Paper%2012-07-07%20final.pdf. ("Diesel oxidation catalysts installed on a vehicle's exhaust system can reduce total PM typically by as much as 25 to over 50 percent by mass, under some conditions depending on the composition of the PM being emitted" [….] "DPFs can achieve up to, and in some cases, greater than a 90 percent reduction in PM. High efficiency filters are extremely effective in controlling the carbon fraction of the particulate, the portion of the particulate that some health experts believe may be the PM component of greatest concern").
[40] Lack et al. 2009, *supra* note 37.

Route (17,000 km shorter than the Cape Horn route) to international trade.[41] Increased emissions will also result from new and expanded resource extraction in the region.[42] This has the potential to cause significant impacts to the Arctic environment and its peoples.[43] It is important that regulations to limit the emissions of harmful pollutants from ocean-going vessels be in place to protect Alaskan communities and the environment, as well as mitigate Arctic warming, before the projected increases in ship traffic occur.

Conclusion

In addition to the well documented impacts of NOx, SOx and PM emissions on human health and the environment, emissions of these pollutants from ocean-going vessels are important contributors to the accelerated global warming that is occurring in Alaska and throughout the Arctic. Many of these emissions have amplified local climate warming impacts in Alaska which will be exacerbated by increased shipping in Arctic waters in the near future. It is thus essential that all Alaskan waters be included in EPA's application to the IMO to have US waters designated as an Emissions Control Area. Application of the more protective ECA standards in Alaskan waters is critical for reducing tropospheric ozone and black carbon in Alaska and the Arctic. We urge EPA to include Alaska in its application to the IMO for ECA designation. If EPA cannot do so before the deadline for submission of the application, we request that EPA amend its application before it is voted on by the IMO.

If you have any questions about this letter, or if we can be of further assistance in this matter, please contact Sarah Burt (sburt@earthjustice.org) or Erica Rosenthal (erosenthal@earthjustice.org) at (510) 550-6700.

Sincerely,

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[41] Wilson, K. et al., *Shipping in the Canadian Arctic: Other Possible Climate Change Scenarios*, Geoscience and Remote Sensing Symposium, IGARSS '04 Proceedings, September 2004, available at: http://www.arctic.noaa.gov/detect/KW_IGARSS04_NWP.pdf. *See also* Jim Berner et al., *Arctic Climate Impact Assessment Scientific Report*, Cambridge University, (2004), at 83, available at http://amap.no/acia/; R.W. Lindsay & J. Zhang, *The Thinning of Arctic Sea Ice, 1988–2003: Have We Passed a Tipping Point?* 18 Journal of Climate 4879 (2005); J. Stroeve et al., *Arctic Sea Ice Extent Plummets in 2007*, 89 Eos Trans. Amer. Geophys. Union 13 (2008), available at http://www.agu.org/pubs/crossref/2008/2008EO020001.shtml; J. Richter-Menge et al., *Sea Ice Cover*, in NOAA Arctic Report Card 2007, available at http://www.arctic.noaa.gov/reportcard/seaice/html (in 2007, sea ice extent was thirty-nine percent lower than the long-term average from 1979 to 2000).
[42] Wilson et al. 2004, *supra* note 42.
[43] *Id.*

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