CENTER *for* BIOLOGICAL DIVERSITY

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via Electronic and Certified Mail

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Re: Sixty-Day Notice of Intent to Sue for Violations of the Clean Water Act and Administrative Procedure Act for Failure to Develop Water Quality Criteria for Black Carbon on Sea Ice and Glaciers

This letter serves as a sixty-day notice on behalf of the Center for Biological Diversity ("Center") of intent to sue the Environmental Protection Agency ("EPA") for violations of Section 304 of the Clean Water Act (33 U.S.C. § 1251 *et seq.*) for EPA's failure to develop and publish water quality criteria and information to address black carbon pollution on sea ice and glaciers as required by Section 304 of the Clean Water Act. 33 U.S.C. § 1314(a)(1) & (2). This notice is pursuant to the Section 505(a)(2) of the Clean Water Act to notify EPA that unless it corrects these violations within the next 60 days, the Center will seek redress in federal court. 33 U.S.C. § 1365(a)(2); 40 C.F.R. § 135.

EPA has also violated the Administrative Procedure Act by failing to answer the Center's formal petition requesting that EPA develop and publish water quality criteria and information to address black carbon pollution on sea ice and glaciers. This constitutes unreasonable delay in violation of the Administrative Procedure Act. 5 U.S.C. § 706(1). In addition, EPA has unlawfully withheld agency action because it has the duty under Section 304 of the Clean Water Act to take the requested actions. 5 U.S.C. § 706(2).

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I. IDENTIFICATION OF THE PARTIES

The Center is a nonprofit environmental organization dedicated to protecting endangered species and wild places through rigorous science, advocacy, and environmental law. The Center's Climate Law Institute develops and implements legal campaigns to limit global warming pollution and prevent it from driving species extinct. The Center has over 320,000 members and online activists. Some of the Center's members, online activists, and staff reside near and frequently visit sea ice and glaciers impacted by black carbon deposition to observe, research, recreate, and otherwise use and enjoy these resources and the ecosystem services they provide. EPA's failure to comply with environmental laws to protect sea ice and glaciers is harming the interests of the Center and its members.

II. CLEAN WATER ACT BACKGROUND

Congress enacted the Clean Water Act, 33 U.S.C. §§ 1251 et seq., with the express purpose of "restor[ing] and maintain[ing] the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). Congress intended to protect "water quality which provides for the protection and propagation of fish, shellfish, and wildlife" and provides for the continuing beneficial use of our waters for recreation. *Id.* § 1251(a)(2).

Toward those goals, the Clean Water Act requires the EPA to establish national water quality criteria, 33 U.S.C. § 1313(a)(1), and to publish information that will guide states in their adoption and periodic review of water quality standards, 33 U.S.C. § 1313(a)(2). Water quality criteria and information, and revisions thereof, are required to be issued to the states and published in the Federal Register and otherwise be made available to the public. 33 U.S.C. § 1313(a)(3).

Under section 304(a)(1), Congress mandated that the EPA "shall" develop and publish and "from time to time thereafter revise" water quality criteria "accurately reflecting the latest scientific knowledge:"

> (A) on the kind and extent of all identifiable effects on health and welfare including, but not limited to, plankton, fish, shellfish, wildlife, plant life, shorelines, beaches, esthetics, and recreation which may be expected from the presence of pollutants in any body of water, including ground water;
> (B) on the concentration and dispersal of pollutants, or their byproducts, through biological, physical, and chemical processes; and
> (C) on the effects of pollutants on biological community diversity, productivity, and stability, including information on the factors affecting rates of eutrophication and rates of organic and inorganic sedimentation for varying types of receiving waters.

Section 304(a)(2) requires that EPA "shall" develop and publish "and from time to time thereafter revise" information on four topics necessary to protection of water quality:

> (A) on the factors necessary to restore and maintain the chemical, physical, and biological integrity of all navigable waters, ground waters, waters of the contiguous zone, and oceans;
> (B) on the factors necessary for the protection and propagation of shellfish, fish, and wildlife for classes and categories of receiving waters to allow recreational activities in and on the water;
> (C) on the measurement and classification of water quality; and
> (D) for the purpose of section 1313 of this title, on the identification of pollutants suitable for maximum daily load measurement correlated with the achievement of water quality objectives.

"[W]hen a statute uses the word 'shall,' Congress has imposed a mandatory duty upon the subject of the command." *Forest Guardians v. Babbitt*, 174 F.3d 1178, 1187 (10th Cir. 1998). The duty to review and consider required factors, such as the latest scientific knowledge, is a non-discretionary duty.

III. SCIENTIFIC BACKGROUND ON BLACK CARBON AND ITS IMPACT ON SEA ICE AND GLACIERS

A. Black Carbon Deposition Accelerates the Melt of Sea Ice and Glaciers by Reducing the Reflectivity of Snow and Ice

Black carbon is an airborne particle generated from the incomplete combustion of fossil fuels, biofuels, and biomass. Black carbon has both a direct warming effect, by absorbing solar radiation in the atmosphere and converting it to heat radiation, and an indirect effect, by reducing the reflectivity (albedo) of snow and ice when deposited on these surfaces. Because it turns snow and ice darker, black carbon deposition accelerates the melt of sea ice and glaciers.[1] The direct and indirect warming effects of black carbon make it one of the most important contributors to the retreat of Arctic sea ice.[2] Snow and ice contaminated with black carbon heat the Arctic surface very efficiently due to strong Arctic temperature inversions and the insulating properties of snow.[3] In the spring, deposition of black carbon onto snow and ice yields a positive forcing that increases surface temperature by approximately 0.5°C.[4] During springtime in the Arctic, black

[1] V. Ramanathan & G. Carmichael, *Global and Regional Climate Changes Due to Black Carbon*, 1 NATURE GEOSCIENCE 221, 222 (2008); *EPA Black Carbon and Global Warming: Hearing Before the H. Comm. on Oversight and Gov't. Reform*, 110th Cong. at 16 (2007) [hereinafter *Hearing*] (statement of Mark Z. Jacobson, Professor, Stanford University).
[2] Ramanathan & Carmichael, *supra* note 1, at 224.
[3] *Hearing*, *supra* note 1, at 72 (statement of Charles Zender, Associate Professor, University of California at Irvine).
[4] P.K. Quinn et al., S*hort-lived Pollutants in the Arctic: Their Climate Impact and Possible Mitigation Strategies*, 8 ATMOSPHERIC CHEMISTRY & PHYSICS 1723, 1731 (2008).

carbon's direct warming effect on snow can be three times as strong as carbon dioxide.[5] Because of its combined heating of the Arctic atmosphere and of the surface, black carbon is believed to warm the Arctic more than any other agent except carbon dioxide.[6]

Black carbon has an even greater impact on seasonal snow and ice because it causes earlier exposure of underlying low-albedo surfaces (e.g., rock, soil, vegetation and ocean).[7] Over the course of the Arctic spring, black carbon-contaminated snow absorbs enough extra sunlight to melt earlier – weeks earlier in some places – than clean snow.[8] As snow and ice surfaces continue to warm, melt, darken and lose contrast with black carbon, the net warming effect of black carbon on the Arctic will decrease.[9] Thus, reducing black carbon now will have more of an impact than delaying reductions.

Black carbon's impact on the melting of snow and sea ice applies with equal force to the decrease in albedo of glaciers in montane regions and consequent accelerated melt-off. Black carbon depositions on Tibetan glaciers have been found to be a significant contributing factor to observed rapid glacier retreat.[10] By increasing surface melt on ice masses, black carbon triggers positive feedbacks because the resulting melt water spurs multiple radiative and dynamic feedback processes that accelerate ice disintegration.[11] Moreover, in the case of glaciers, by increasing water flow through crevasses and moulins, black carbon speeds freeze-thaw ice break-up and lubrication of the ice sheet base.[12]

Pristine Antarctic regions have been found to contain black carbon concentrations of 0.1-0.3 ppbw (parts per billion by weight), two orders of magnitude less than the Arctic.[13] Notably, black carbon amounts of 3 ppbw were found 1 km downwind of the South Pole station, where the station's power plant and aircraft operations were a suspected source.[14] Snow samples in the 1980s, including sites in Alaska and on sea ice in the central Arctic, yielded typical black carbon amounts of 10-50 ppbw.[15] While black

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[5] *Hearing, supra* note 1, at 73 (statement of Charles Zender, Associate Professor, University of California at Irvine); *see also* M. Flanner et al., *Present-Day Climate Forcing and Response from Black Carbon in Snow*, 112 J. GEOPHYSICAL. RES. D11202 at 15 (2007) ("BC snowpack can provoke disproportionately large springtime climate response because the forcing tends to coincide with the onset of snowmelt, thus triggering more rapid snow ablation and snow-albedo feedback.").

[6] *Hearing, supra* note 1, at 73 (statement of Charles Zender, Associate Professor, University of California at Irvine).

[7] Joseph McConnel et al., *20th-Century Industrial Black Carbon Emissions Altered Arctic Climate Forcing*, 317 SCIENCE 1381, 1383 (2007).

[8] *Hearing, supra* note 1, at 72 (statement of Charles Zender, Associate Professor, University of California at Irvine).

[9] *Hearing, supra* note 1, at 71 (statement of Charles Zender, Associate Professor, University of California at Irvine).

[10] Baiqing Xu et al., *Black Soot and the Survival of Tibetan Glaciers*, 106 PROC. NAT'L ACAD. SCI. U.S. 22114 (2009), *available at* http://www.pnas.org/content/106/52/22114.full.

[11] James Hansen & Larissa Nazarenko, *Soot Climate Forcing via Snow and Ice Albedos*, 101 PROC. NAT'L ACAD. SCI. U.S. 423, 427 (2004), *available at* http://www.pnas.org/content/101/2/423.full.

[12] *Id.*

[13] *Id.* at 424.

[14] *Id.*

[15] *Id.* at 423.

carbon emissions may have fallen in the 1990s due to the economic collapse of the former Soviet Union, reduced black carbon emissions are not necessarily permanent in the face of possible economic recovery, increased shipping in the opening Northwest and Northeast Passages, regional hydrocarbon resource development, and increased use of diesel-powered vehicles.[16] Measurements in the Alps revealed black carbon concentrations as large as 100 ppbw, enough to reduce the visible albedo by approximately 10% and double absorption of sunlight.[17] However, because of the positive feedbacks resulting from black carbon deposition, much smaller concentrations of black carbon perturb snowmelt. In today's warmer climate, very small concentrations of black carbon impurities (~ 10 ppb) are triggering astonishingly large ice-albedo warming.[18]

B. Reducing Black Carbon Emissions is Critical to Avoiding Complete Loss of Summer Arctic Sea Ice

While reductions in carbon dioxide pollution must be the core of any meaningful effort to mitigate the impacts of global warming, even if swift and deep reductions in carbon dioxide emissions are made, given the long lifetime of carbon dioxide in the atmosphere, these reductions may not be achieved in time to prevent the complete loss of summer sea ice in the Arctic and of U.S. glaciers. Because black carbon emitted today will largely leave the atmosphere in a month or less, reducing black carbon emissions reduces warming within weeks.[19] Major cuts in black carbon emissions could slow the effects of climate change for a decade or two, buying policy makers more time to cut carbon dioxide emissions and potentially avoid irreversible effects of global warming.[20] Thus, restoration of snow albedos to levels approaching pristine pre-industrial values has the double benefit of reducing global warming and pushing back the point at which catastrophic anthropogenic interference with the climate occurs.[21]

IV. THE ATMOSPHERIC DEPOSITION OF BLACK CARBON ON SEA ICE AND GLACIERS IS SUBJECT TO REGULATION UNDER THE CLEAN WATER ACT

A. Sea Ice and Glaciers are Waters of the United States Afforded Protection Under the Clean Water Act

1. <u>Sea ice</u>

Sea ice is frozen seawater that floats on the ocean surface. Blanketing millions of square kilometers, sea ice forms and melts with the polar seasons, affecting both human activity and biological habitat. Arctic sea ice approaches its annual maximum in late

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[16] *Id.* at 424.
[17] *Id.* at 427.
[18] *Hearing, supra* note 1, at 74 (statement of Charles Zender, Associate Professor, University of California at Irvine).
[19] *See, e.g., Hearing, supra* note 1, at 17 (statement of Mark Z. Jacobson, Professor, Stanford University).
[20] *Id.* at 53 (statement of V. Ramanathan, Professor, University of San Diego).
[21] Hansen & Nazarenko, *supra* note 11, at 423.

winter.[22] In February 2009, sea ice extended along the northern and western shores of Alaska.[23] However, the monthly average sea ice extent for February 2009 was the fourth lowest in the satellite record, with February 2005 having the lowest extent, February 2006 the second lowest, and February 2008 the third lowest. Including 2009, the downward linear trend in February sea ice extent over the satellite record stands at -2.8 percent per decade.[24] Arctic sea ice reaches its minimum extent in September. Sea ice extent in 2009 was the third lowest since the start of the satellite record in 1979, with the past five years having the five lowest sea ice extents on record.[25] Nearly 40 percent of the sea ice area that was present in the 1970s was lost by 2007, the lowest year on record.[26] The observed summertime melting of Arctic sea ice has far exceeded the worst-case projections of climate models in the Fourth Assessment Report of the International Panel on Climate Change.[27] Scientists now predict that a seasonally ice-free Arctic Ocean could be realized by 2030.[28]

Protection of sea ice falls within the jurisdiction of the Clean Water Act because the Act explicitly encompasses protection of territorial seas off the coast of Alaska where sea ice seasonally forms. "Navigable waters" is defined under the Act as "the waters of the United States, including the territorial seas."[29] "Territorial seas" is in turn defined as the "belt of the seas measured from the line of ordinary low water along that portion of the coast which is in direct contact with the open sea and the line marking the seaward limit of inland waters, and extending seaward a distance of three miles."[30] In addition, Section 304(a)(2) requires EPA to develop and publish information "on the factors necessary to restore and maintain the chemical, physical, and biological integrity of all navigable waters, ground waters, waters of the contiguous zone, and *the oceans*."[31]

While there has been little explicit discussion to date of specific protection for water in its solid form under the Act, courts have not distinguished between discharges of pollutants onto ice or water when enforcing the Clean Water Act.[32] For purpose of the Clean Water Act, a "navigable water" need not be navigable in fact to be afforded the

[22] National Snow & Ice Data Center, Arctic Sea News & Analysis, *Ice Extent Reaches Annual Maximum* (2009), http://nsidc.org/arcticseaicenews/2009/030309.html.
[23] *Id.*
[24] *Id.*
[25] Press Release, National Snow & Ice Data Center, Arctic Sea Ice Extent Remains Low; 2009 Sees Third-Lowest Mark (Oct. 6, 2009), *available at* http://nsidc.org/news/press/20091005_minimumpr.html.
[26] WORLD WILDLIFE FUND INT'L, ARCTIC CLIMATE FEEDBACKS: GLOBAL IMPLICATIONS 8 (Martin Sommerkorn & Susan Joy Hassol eds., 2009).
[27] UNIV. OF NEW SOUTH WALES RESEARCH CENTRE, THE COPENHAGEN DIAGNOSIS, UPDATING THE WORLD ON THE LATEST CLIMATE SCIENCE 31 (2009); WORLD WILDLIFE FUND INT'L, *supra* note 26, at 8.
[28] K. Stoeve et al, *Arctic Sea Ice Extent Plummets in 2007*, 89 EOS 13, 14 (Jan. 2008); *see also* M. Wang & J.E. Overland, *A Sea Ice Free Summer Arctic Within 30 Years?*, 36 GEOPHYSICAL. RES. LETTERS L07502 (2009) (predicting near ice-free Arctic by 2037).
[29] Clean Water Act § 502(7), 33 U.S.C. § 1362(7) (2006).
[30] Clean Water Act § 502(8), 33 U.S.C. § 1362(8) (2006).
[31] Clean Water Act § 304(a)(2), 33 U.S.C. § 1314(a)(2) (2006) (emphasis added).
[32] *See, e.g., United States v. Hamel*, 551 F.2d 107 (6th Cir. 1977) (affirming conviction for willful discharge of gasoline onto ice overlying lake).

protections of the Act.[33] Indeed, in passing the Clean Water Act, Congress did not intend to use the term "navigable waters" in the traditional sense, but to "extend the coverage of the act as far as permissible under the commerce clause."[34] Accordingly, there is no legitimate basis to withhold Clean Water Act protection to sea ice because it is a solid.

Protection of sea ice also furthers the purpose of the Clean Water Act, which is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[35] Sea ice is a fundamental component of the Arctic marine ecosystem. For example, the volume and timing of sea ice melt is intimately connected to the chemical, physical and biological integrity of Arctic waters. Sea ice impacts the physical integrity of Arctic waters through alterations in temperature and light. The Arctic food web is delicately balanced to take advantage of the seasonal timing of sea ice melt. When sea ice melts, ocean temperature and light increase, with a consequent increase in photosynthesis by phytoplankton. Phytoplankton are a food source for zooplankton that rise from deeper waters at specific times in the spring to feed. If sea ice melts early, the coupling between photosynthetic production and zooplankton demand becomes uncoupled.[36] This trophic mismatch has reverberating consequences throughout the food web. Furthermore, warmer waters that are less saline as a result of melted sea ice become more stratified so that less nutrient cycling occurs between the surface and deep waters, causing further adverse impacts to the Arctic food web.[37]

The chemical integrity of the oceans is also powerfully influenced by sea ice dynamics. The volume of sea ice melt has direct impacts on ocean acidification. Ocean acidification refers to the decrease in ocean pH that occurs when oceans absorb carbon dioxide from the atmosphere. As pH decreases, carbonate concentrations also decrease. Carbonate and calcium are essential for many organisms, such as plankton and shellfish, to form their shells. One of the common forms of calcium carbonate is aragonite, and the cold waters of the Arctic tend to have lower concentrations of aragonite than mid-latitude oceans.[38] Aragonite undersaturation is exacerbated with the loss of sea ice through multiple mechanisms. First, when sea ice melts there is an influx of freshwater that causes a reduction in salinity and total alkalinity, which in turn reduces carbonate concentrations.[39] Second, sea ice tends to have a lower concentration of dissolved

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[33] *See, e.g.,* EPA & Army Corps of Engineers, *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States* (Dec. 2, 2008).

[34] *Quivira Mining Co. v. U.S. Envtl Prot. Agency*, 765 F.2d 126, 130 (10th Cir. 1985) (citing *United States v. Texas Pipe Line Co.*, 611 F.2d 345, 347 (10th Cir. 1979).

[35] Clean Water Act § 101(a), 33 U.S.C. § 1251(a) (2006).

[36] K.L. Laidre et al., *Quantifying the Sensitivity of Arctic Marine Mammals to Climate-Induced Habitat Change*, 18 ECOLOGICAL APPLICATIONS S97, S99 (2008); A.S. Hansen et al., *Impact of Changing Ice Cover on Pelagic Productivity and Foodweb Structure in Disko Bay, West Greenland: A Dynamic Model Approach*, 50 DEEP SEA RESEARCH I 171, 182 (2003).

[37] N.R. Bates & J.T. Mathis, *The Arctic Ocean Marine Carbon Cycle: Evaluation of Air-Sea CO_2 Exchanges, Ocean Acidification Impacts and Potential Feedbacks,* 6 BIOGEOSCIENCES 2433, 2448 (2009).

[38] V.J. Fabry et al., *Impacts of Ocean Acidification on Marine Fauna and Ecosystem Processes,* 65 INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA (ICES) JOURNAL OF MARINE SCIENCES 414, 415 (2008).

[39] M. Yamamoto-Kawai et al., *Aragonite Undersaturation in the Arctic Ocean: Effects of Ocean Acidification and Sea Ice Melt*, 326 SCIENCE 1098, 1099 (2009).

inorganic carbon, which also intensifies ocean aragonite undersaturation when meltwater enters the oceans.[40] Third, sea ice cover reduces the surface of the ocean that is exposed to the air. Because carbon dioxide exchange occurs at the interface of the sea and air, when more surface ocean is exposed with sea ice melt, more carbon dioxide is absorbed by the oceans.[41]

Besides the extensive biological impacts of the chemical and physical status of the oceans, sea ice itself also confers exceedingly important ecological benefits. Krill, an important food source for many marine organisms including cetaceans, overwinter in sea ice, and krill availability is directly correlated to ice extent.[42] For many marine mammals sea ice habitat is as important as aquatic habitat.[43] For instance, narwhals depend on winter sea ice for foraging.[44] Pinnipeds such as walrus and seals also depend on sea ice for foraging as well as breeding and resting.[45] Polar bears depend on sea ice as hunting platforms as well as denning and whelping.[46] Finally, sea ice supports an abundant microbial and algal ecosystem within the ice matrix.[47] This intra-ice ecosystem productivity provides food for small amphipods that live under the ice, which in turn are food for diving birds and cod.[48]

Adverse impacts resulting from the accelerated loss of Arctic sea ice extend well beyond the Arctic Ocean and its coast. By reflecting the sun's energy back into space, sea ice is an effective insulator, preventing heat in the Arctic Ocean from escaping upward and warming the lower atmosphere.[49] The decline of sea ice amplifies warming in the Arctic, which in turn has major implications for temperature patterns over adjacent, permafrost-dominated land areas and for weather patterns across the Northern Hemisphere.[50] Rapid retreat of Arctic sea ice is predicted to accelerate warming 1,500 kilometers inland throughout Alaska, Canada and Russia.[51] During rapid ice retreat, the rate of inland warming could be more than three times that previously suggested by

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[40] *Id.*
[41] *Id.*; Bates & Mathis, *supra* note 37 at 2446.
[42] K.F. Drinkwater et al., *On the Processes Linking Climate to Ecosystem Changes*, 79 JOURNAL OF MARINE SYSTEMS 374, 378 (2010).
[43] See, e.g., Laidre *supra* note 36; E. Post et al., *Ecological Dynamics Across the Arctic Associated with Recent Climate Change*, 325 SCIENCE 1355, 1355 (2009).
[44] Laidre, *supra* note 36 at S101.
[45] *Id.*; Drinkwater, *supra* note 42.
[46] *Id.*
[47] B.A. Bluhm & R. Gradinger, *Regional variability in food availability for Arctic marine mammals*, 18 ECOLOGICAL APPLICATIONS S77, S83 (2008).
[48] *Id.* at S84.
[49] WORLD WILDLIFE FUND INT'L, *supra* note 26, at 19-20.
[50] *Id.* at 18.
[51] UNITED NATIONS ENVIRONMENTAL PROGRAMME, CLIMATE CHANGE 2009 SCIENCE COMPENDIUM 19 (Catherine McMullen ed., 2009). The disappearance of the Arctic ice cap during the sunlit period of the year would radically reduce the local albedo and cause an annually averaged 19.7 Wm^{-2} increase in absorbed solar flux at the Arctic Ocean surface, or equivalently an annually averaged 0.55 Wm^{-2} increase on the planetary scale. C. Matsoukas et al., *The Effect of Arctic Sea-Ice Extent of the Absorbed (Net) Solar Flux at the Surface, Based on ISCCP-D2 Cloud Data for 1983-2007*, 10 ATMOSPHERIC CHEMISTRY & PHYSICS 777, 777 (2010).

global climate models.[52] Higher temperatures will thaw out extensive expanses of permafrost, resulting in the potential release of methane and carbon dioxide that are currently frozen in Arctic soils thereby further accelerating additional warming.[53] Additional warming in the Arctic resulting from the loss of sea ice will also affect weather patterns by altering atmospheric circulation patterns and, through it, weather patterns affecting transportation, agriculture, forestry and water supplies.[54] Loss of sea ice in the Arctic Ocean will therefore have serious repercussions as climactic feedbacks resulting from higher temperatures accelerate, the timing of the seasons is altered, and shifting circulation patterns cascade through the Arctic and beyond.

2. Glaciers

The World Glacier Monitoring Service defines a glacier as "a mass of surface-ice on land which flows downhill under gravity and is constrained by internal stress and friction at the base and sides."[55] Glaciers and ice caps cover 10% of the Earth's surface and provide about 75% of the world's fresh water.[56] Glaciers in the U.S. are located in Alaska and the continental U.S. from the Rockies westward. Nine western states of the contiguous U.S. have glaciers: Washington, California, Oregon, Montana, Wyoming, Colorado, Idaho, Utah, and Nevada.[57] The glaciers of the continental U.S. have a total area of approximately 580 sq. km[58] and constitute 7% of world glacier area.[59] Washington State accounts for approximately 75% of U.S. glacial extent outside of Alaska.[60] Alaska contains approximately 11% of world glacier area.[61] Like sea ice, the Earth's glaciers as a whole are exhibiting rapid recession.[62] For example, the number of glaciers at Glacier National Park has dropped from 150 to 26 since 1850, with some projections suggesting that if current trends in the rate of melting continue, the remaining glaciers will disappear within the next 25 to 30 years.[63]

America's glaciers are afforded protection under the Clean Water Act because they feed traditional navigable waters and because glaciers meet the "significant nexus" test set forth by Justice Kennedy in *Rapanos v. United States*, 547 U.S. 715 (2006).

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[52] UNITED NATIONS ENVIRONMENTAL PROGRAMME, *supra* note 51, at 19.
[53] *Id.*
[54] WORLD WILDLIFE FUND INT'L, *supra* note 26, at 23.
[55] World Glacier Monitoring Service, *Global Glacier Changes: Facts and Figures* at 10 (2009).
[56] P. Jansson et al., *The Concept of Glacier Storage: a Review.* 282 J. HYDROLOGY 116, 117 (2003).
[57] Listed in order of glacier extent. R.M. Krimmel, *Glaciers of the Western United States, in* SATELLITE IMAGE ATLAS OF GLACIERS OF THE WORLD 329, Table 1 (J. Williams & J. Ferrigno, eds., 2002).
[58] *Id.* at 329.
[59] R.G. Barry, *The Status of Research on Glaciers and Global Glacier Recession: A Review*, 30 PROGRESS IN PHYSICAL GEOGRAPHY 285, 286 (2006).
[60] Krimmel, *supra* note 57 at 343, *see* Table 1 for individual states.
[61] Barry, *supra* note 59 at 286.
[62] P. Lemke et al., *Chapter 4, Observations: Changes in Snow, Ice and Frozen Ground 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 356 (S. Solomon et al. eds., 2007).
[63] GOVERNMENT ACCOUNTABILITY OFFICE, CLIMATE CHANGE: AGENCIES SHOULD DEVELOP GUIDANCE FOR ADDRESSING THE EFFECTS ON FEDERAL LAND AND WATER RESOURCES 18 (Aug. 2007), *available at*: http://www.gao.gov/news.items/d07863.pdf.

The "Clean Water Act is concerned with the pollution of tributaries as well as with the pollution of navigable streams, and 'it is incontestable that substantial pollution of one not only may but very probably will affect the other.'"[64] Thus, Clean Water Act jurisdiction extends to non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally.[65] A non-navigable tributary of a traditional navigable water is a non-navigable water body whose waters flow into a traditional navigable water either directly or indirectly by means of other tributaries.[66] Glaciers meet this definition because their waters flow into traditional navigable waters such as rivers and oceans. Indeed, due to their many important ecological functions, glaciers are considered "part of the fresh waters ecosystem."[67]

Glacial runoff comes from a variety of sources such as surface melting, melting by geothermal heat, precipitation that falls on glaciers, and pressure melting.[68] Kryal streams, which are fed directly by glacial melt, are one of the main types of alpine stream flow contributing to downstream waters.[69] Indeed, glaciers significantly influence most of Alaska's major rivers, even though glaciers cover just 5% of the state.[70] Similarly, most of the water flowing into the Gulf of Alaska from the Susitna River comes from mountain glaciers.[71] Glaciers in the continental United States are also a water source for downstream rivers. For example, Triple Divide Peak in Glacier National Park contributes to three major river systems: the Columbia, Saskatchewan, and Missouri.[72] Similarly, glaciers on Mt. Rainier feed five major rivers: Nisqually, Cowlitz, White, Carbon, and Puyallup.[73]

Glaciers are also water bodies with continuous seasonal flow. Joint EPA/Army Corps of Engineer guidance provides that a water body is seasonal if it exists "typically

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[64] *Headwaters, Inc. v. Talent Irrigation Dist.*, 243 F.3d 526, 534 (9th Cir. 2001) (citation omitted).

[65] EPA & Army Corps of Engineers, *supra* note 33, at 6; *see also United States v. TGR Corp.,* 171 F.3d 762, 764 (2d Cir. 1999) (non-navigable tributaries flowing into navigable streams are "waters of the United States"); *Quivira Mining Co v. EPA*, 765 F.2d 126, 130 (10th Cir. 1985) (creeks and arroyos connected to streams during intense rainfall are "waters of the United States"); *United States v. Texas Pipe Line Co.*, 611 F.2d 345, 347 (10th Cir. 1979) (oil spill into tributary involved "waters of the United States," even though no evidence tributary was discharging into traditional navigable waters at time of spill).

[66] EPA & Army Corps of Engineers, *supra* note 33, at 6.

[67] GOVERNMENT ACCOUNTABILITY OFFICE, *supra* note 63, at 159.

[68] Randy Bowersox, *Hydrology of a Glacial Dominated System, Copper River, Alaska, in* GLACIAL AND PERIGLACIAL PROCESSES AS HYDROGEOMORPHIC AND ECOLOGICAL DRIVERS IN HIGH-LATITUDE WATERSHEDS 2 (J. Mount et al. eds., 2002).

[69] F.R. Hauer et al., *Pattern and Process in Northern Rocky Mountain Headwaters: Ecological Linkages in the Headwaters of the Crown of the Continent*, 43 J. AM. WATER RESOURCES ASS'N 104, 107 (2007).

[70] Alaska Department of Natural Resources, Division of Mining, Land & Water, Alaska Hydrologic Survey, http://dnr.alaska.gov/mlw/water/hydro/index.htm (last visited January 26, 2010).

[71] NASA Earth Observatory, Alaska Glaciers and Rivers: Image of the Day, http://earthobservatory.nasa.gov/IOTD/view.php?id=8117 (last visited January 27, 2010).

[72] F.R. Hauer et al., *supra* note 69, at 105.

[73] *See* National Park Service, *The Little Tahoma News*, http://www.nps.gov/archive/mora/kids/student5.htm (last visited Jan. 28, 2010).

three months" of the year.[74] Glaciers at all latitudes exhibit annual ablation (melt/loss of snow and ice) during late spring and summer, a span of at least three months.[75] At low latitudes, ablation occurs year-round.[76]

Protection of glaciers under the Clean Water Act is warranted on the alternative grounds that glaciers meet the jurisdictional test articulated by Justice Kennedy in *Rapanos v. United States,* 547 U.S. 715 (2006) for what constitutes a regulable water under the Act.[77] In *Rapanos,* Justice Kennedy held that Clean Water Act jurisdiction extends to waters or wetlands that "possess a 'significant nexus' to waters that are or were navigable in fact or that could reasonably be so made."[78] A significant nexus exists if "either alone or in combination with similarly situated lands in the region, [they] significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.'"[79]

Glaciers meet the significant nexus test because they significantly affect the chemical, physical, and biological integrity of downstream waters. Chemical impacts of glaciers to downstream waters include water dilution and increased pollutant loads. For instance, meltwater contributions from glaciers tend to be relatively dilute with low nutrient content, but with glacier retreat, downstream waters will have greater exposure to soils that could contribute more ions such as phosphorus and nitrogen.[80] Because glaciers also concentrate volatile organic compounds transported from agricultural and industrial activity, increased melt rates will result in greater amounts of these compounds being deposited in downstream waters.[81] The same has been observed for organochlorides.[82] Glacial retreat can result in additional dangers to water quality, including increased

[74] EPA & Army Corps of Engineers, *supra* note 33, at 7.
[75] P. Lemke et al., *Chapter 4, Observations: Changes in Snow, Ice and Frozen Ground 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 356 (S. Solomon et al. eds., Cambridge Univ. Press 2007).
[76] *Id.*
[77] *Rapanos* was decided in a fractured 4-1-4 decision, with Justice Kennedy's concurrence providing the deciding vote. In interpreting *Rapanos*, circuit courts have determined that either: (1) Justice Kennedy's concurrence provides the controlling rule of law; or (2) jurisdictional requirements are met if either the test articulated by Justice Kennedy or the plurality in *Rapanos* is met. Under either interpretation, regulatory jurisdiction would be established if Justice Kennedy's test is satisfied. *See, e.g., United States. v. Gerke Excavating, Inc.,* 464 F.3d 723, 724 (7th Cir. 2006) (Kennedy concurrence controlling); *Northern California River Watch v. City of Healdsburg*, 496 F.3d 993, 999-1000 (9th Cir. 2006) (same); *United States v. Johnson*, 467 F.3d 56, 66 (1st Cir. 2006) ("federal government can establish jurisdiction over the target sites if it can meet either the plurality's or Justice Kennedy's standard").
[78] *Rapanos v. United States,* 547 U.S. 715, 759 (2006).
[79] *Id.* at 780.
[80] R.D. Moore et al., *Glacier Change in Western North America: Influences on Hydrology, Geomorphic Hazards and Water Quality.* 23 HYDROLOGICAL PROCESSES 42, 53 (2009); F.R. Hauer et al., *supra* note 69, at 107.
[81] R.D. Moore et al., *supra* note 80, at 53.
[82] C. Rosenzweig et al., *Chapter 1. Assessment of Observed Changes and Responses in Natural and Managed Systems in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 91 (M.L. Parry et al. eds., Cambridge Univ. Press 2007).

suspended sediment load and increased water temperature.[83] Changes in water temperature can result in thermal stratification and reduced nutrient cycling.[84]

The physical integrity of downstream waters in a large number of water basins is dependent on glacial meltwaters. One of the main services provided by glaciers is water storage. Water storage occurs both as frozen water in the form of ice as well as precipitation stored in glacial aquifers.[85] In many areas summer melt provides a regulating influence to maintain stream flows during the dry season.[86] The importance of glacial water sources operates at multi-year, seasonal, and daily time scales.[87] Non-ice sheet glaciers are also significant because they can change extent much more rapidly than ice sheets, and thus are the current greatest contributor to increases in sea level.[88] In fact, it is estimated that the world's non-ice sheet glaciers would cause a 0.65 ± 0.16 m rise in sea level if they melted completely.[89] Glacial water storage and release also has important implications for hydroelectric power plants, irrigation, consumptive use, and local ecosystems.[90] Decreasing summer runoff will result in lower water levels in lakes and rivers, which in turn will cause re-suspension of sediment and free harmful compounds within the sediment.[91] Destabilization due to glacial retreat can also increase the risk of "geomorphic hazards" such as floods, avalanches, and debris flow.[92]

Perhaps most important are the ecosystem services provided by glacier water systems. The detrimental chemical and physical effects of glacial retreat can significantly impact the biological integrity of downstream ecosystems. For instance, freshwater temperature is extremely important for salmon spawning.[93] The increased temperature in late summer due to glacial recession would represent yet another stress to species that are already imperiled. On the other hand, abundance of macroinvertebrates is likely to increase with reduced meltwater contributions.[94] This increase in abundance at a given site, however, will likely be accompanied by a *decrease* in biodiversity between streams or within a region.[95] This is due to the fact that streams will become more homogeneous in their characteristics and thus species highly-adapted for conditions

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[83] R.D. Moore et al., *supra* note 80, at 53-55.
[84] C. Rosenzweig et al., *supra* note 82, at 91.
[85] P. Jansson et al., *supra* note 56, at 119-22.
[86] R.D. Moore et al., *supra* note 80, at 48.
[87] P. Jansson et al., *supra* note 56, at 117-19, 123.
[88] *Id.* at 118.
[89] M.B. Dyurgerov & M.F. Meier, *Glaciers and the Changing Earth System: A 2004 Snapshot* at 7, Occasional Paper 58 (2005): Institute of Arctic and Alpine Research, University of Colorado.
[90] R.D. Moore et al., *Glacier Change in Western North America: Influences on Hydrology, Geomorphic Hazards and Water Quality.* 23 HYDROLOGICAL PROCESSES 42 (2009).
[91] Z.W. Kundzewicz et al, *Chapter 3, Freshwater Resources and their Management in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 188 (M.L. Parry et al. eds., Cambridge Univ. Press 2007).
[92] R.D. Moore et al., *supra* note 80, at 50.
[93] *Id.* at 56.
[94] L.E. Brown et al., *Vulnerability of Alpine Stream Biodiversity to Shrinking Glaciers and Snowpacks*, 13 Global Change Biology 958, 963 (2007).
[95] *Id.*

that include significant meltwater contributions will be extirpated.[96] These vulnerable species will be lost as the balance of meltwater and other water sources changes for a given stream.

Specialized alpine ecosystems are highly adapted to the temperature and flow conditions that currently exist near glaciers. Due to their highly adapted nature, these ecosystems are vulnerable to small changes and thus would likely be unable to survive a transition to a different stream system.[97] Glaciers also host microbial ecosystems within the ice. These ecosystems are sensitive to heat changes on varying time scales.[98] One study suggests that globally the microoganisms living in cryoconite holes on the surface of glaciers may fix as much as 64 Gg of carbon per year.[99] Thus, loss of glacial extent would reduce this potential for carbon sequestration and further exacerbate global warming.

For glaciers that are part of coastal watersheds, such as those surrounding the Gulf of Alaska, glaciers are an important source of ancient and labile organic matter for the marine environment.[100] Changes in glacier volume due to climactic factors could therefore alter the age, quantity and reactivity of dissolved organic matter entering coastal oceans.[101]

Thus, not only are glaciers directly connected to traditional navigable waters, but they also significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.' Accordingly, EPA has authority to set water quality criteria for glaciers under the Clean Water Act.

B. Atmospheric Depositions of Black Carbon onto Waters of the United States are Subject to Clean Water Act Authority

Air pollution often has serious adverse impacts on water quality. As recognized by EPA, "[a]irborne pollutants from human and natural sources can deposit back onto land and water bodies, sometimes at great distances from the source, and can be an important contributor to declining water quality."[102] Accordingly, pollutants that are emitted into the atmosphere but ultimately impact water quality are regulated under the Clean Water Act. For example, mercury is an airborne pollutant that is regulated under Section 303(d) of the Act.[103] Like black carbon, impairment of a waterbody from

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[96] *Id.*
[97] F.R. Hauer et al., *supra* note 69, at 108.
[98] *See* A. Hodson et al., *Glacial Ecosystems*, 78 ECOLOGICAL MONOGRAPHS 41 (2008).
[99] A.M. Anesio et al., *High Microbial Activity on Glaciers: Importance to the Global Carbon Cycle*, 15 GLOBAL CHANGE BIOLOGY 955 (2009).
[100] Eran Hood et al., *Glaciers as a Source of Ancient and Labile Organic Matter to the Marine Environment*, 462 NATURE 1044 (2009).
[101] *Id.*
[102] EPA, Water: Wetlands, Oceans, and Watersheds, *Air Pollution and Water Quality*, http://www.epa.gov/owow/airdeposition/index.html (last visited Jan. 11, 2010).
[103] E.P.A., Total Maximum Daily Loads (TMDLs) and Mercury, http://www.epa.gov/owow/tmdl/mercury/ (last visited December 28, 2009).

mercury is predominately a result of atmospheric deposition from a “combination of local, regional and international sources.”[104] Therefore, the fact that black carbon impairs sea ice and glaciers as a result of atmospheric deposition is not an impediment to regulation under the Clean Water Act.

V. EPA’S VIOLATIONS OF THE CLEAN WATER ACT AND THE ADMINISTRATIVE PROCEDURE ACT

On February 22, 2010, the Center submitted a formal petition to the EPA requesting that it initiate a rulemaking pursuant to the Clean Water Act, 33 U.S.C. § 1314(a), to address threats posed by black carbon. This Petition for rulemaking specifically requested that the EPA:

(1) Develop national water quality criteria pursuant to section 304(a)(1) stating that black carbon concentrations on sea ice and glaciers should not deviate measurably from preindustrial levels.

(2) Publish information on black carbon pursuant to section 304(a)(2) to guide states in identifying local sources of black carbon emissions and strategies for reducing those emissions.

At this time, EPA has not provided a written response to the petition.

EPA has failed to perform a nondiscretionary duty of the Clean Water Act section 304(a), which requires that it shall review and revise water quality criteria to reflect the latest scientific knowledge and publish information. 33 U.S.C. § 1314(a)(1) & (2). Pursuant to the citizen suit provision of the Clean Water Act, 33 U.S.C. §§ 1365(a)-(b), we intend to sue the EPA for the violations of the Clean Water Act described herein. Moreover, EPA’s failure to perform its duties constitutes agency action unlawfully withheld in violation of the Administrative Procedure Act. 5 U.S.C. § 706(1).

EPA’s failure to answer the Center’s petition also constitutes agency action “unreasonably delayed” in violation of the Administrative Procedure Act. 5 U.S.C. § 706(1). Finally, to the extent that EPA has reviewed the Petition, any decision not to develop and publish water quality criterion for black carbon is arbitrary and capricious in violation of the Administrative Procedure Act. 5 U.S.C. § 706(2).

VI. NAME AND ADDRESS OF NOTICING PARTIES AND COUNSEL

Please direct correspondence regarding this notice letter to:

Matt Vespa
Senior Attorney, Climate Law Institute
Center for Biological Diversity

[104] *Id.*

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VII. CONCLUSION

This notice letter is provided so EPA may correct the violations described above. If EPA does not take corrective actions within 60 days, the Center intends to file suit on behalf of the organization and its members seeking injunctive relief, attorney's fees and litigation causes, and other appropriate relief. If you wish to discuss this matter further, please contact me at the address provided.

Sincerely,

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Matthew Vespa

cc (by certified mail, return receipt requested):

Eric Holder
Attorney General of the United States
United States Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530-0001