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### Recommended Citation

Feldon, Jon. "The Big Black Hole in the Kyoto Protocol: Was the Exclusion of Black Carbon Regulation a "Fatal Law"?" *Sustainable Development Law & Policy*, Winter 2007, 60-62, 85.

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# THE BIG BLACK HOLE IN THE KYOTO PROTOCOL: WAS THE EXCLUSION OF BLACK CARBON REGULATION A “FATAL FLAW”?

by Jon Feldon\*

## INTRODUCTION

Claiming that the Kyoto Protocol (“Protocol”) was “fatally flawed in fundamental ways,”<sup>1</sup> on June 2001, U.S. President George W. Bush simultaneously condemned the landmark international agreement against climate change and announced that the United States would withdraw from participation in it.<sup>2</sup> The United Nations Framework Convention on Climate Change (“UNFCCC”) drafted the Protocol in 1997 in order to fight the potentially catastrophic effects of climate change through an international carbon dioxide (“CO<sub>2</sub>”) emissions reduction plan.<sup>3</sup> Over 160 nations ratified the Protocol. The United States and Australia are the only countries in the developed world not to participate.<sup>4</sup>

While the United States signed the Protocol under the Clinton administration, President Bush withdrew, citing economic concerns and dismay that large, CO<sub>2</sub>-emitting countries such as China and India would be exempt from Protocol emission restrictions as developing nations.<sup>5</sup> Particularly troubling, however, was President Bush’s assertion that the Protocol’s strategy itself was “fundamentally flawed.” In the view of the Bush Administration, the Protocol improperly focused on CO<sub>2</sub> emissions to the exclusion of the greater problems of black carbon (“BC”) and tropospheric ozone.<sup>6</sup> President Bush implied that without a plan to limit BC efforts, curbing worldwide CO<sub>2</sub> emissions is not sufficient to address global warming.

If the Bush Administration’s assertion is true, the implications are staggering. Could it be possible that the countries of the world had come together and devised a way to address one of the most urgent global environmental concerns of the century, only to completely misidentify the nature of the problem? Equally important is to evaluate whether or not the Bush Administration’s assertion is justified. Emerging evidence indicates that BC does play a significant role in contributing to global climate change. This article argues that the Kyoto Protocol is, and will continue to be, a powerful force against climate change whether or not it addresses BC. While BC is unquestionably a powerful contributing factor to climate change, CO<sub>2</sub> remains the largest contributor to the problem, and a long-term solution requires CO<sub>2</sub> reductions as soon as possible.<sup>7</sup> If the Kyoto Protocol can

be amended to incorporate measures to reduce BC emissions without alienating participating countries, then it is ideal to do so. Nonetheless, the overall mission of the Protocol remains sound, even in the face of new information about other contributing factors to climate change.

## WHAT IS BLACK CARBON, AND WHY IS IT A PROBLEM?

BC in the atmosphere consists of incompletely burned, microscopic particulate matter resulting from inefficient combustion.<sup>8</sup> Specifically, when carbon is burned to generate energy and heat the burning process also produces CO<sub>2</sub> and BC emissions; the amount of matter remaining depends upon how completely the carbon is burned.<sup>9</sup> If the process does not burn away all solid matter, or if the byproduct is not sequestered, the resulting particulates of solid carbon become atmospheric BC.

BC is not only a byproduct of power production. Additionally, in developed countries the primary source of BC is from industrial pollution and motor vehicle emissions.<sup>10</sup> Less developed nations mainly produce BC by burning sooty fuels, using wood-burning stoves and heaters, and clearing land by burning crops and forests.<sup>11</sup> Industrialized countries release more CO<sub>2</sub> than BC, because their technology allows them to burn carbon with high efficiency.<sup>12</sup> On the other hand, half

of the world’s atmospheric BC comes from the burning of fields and forests; 30 percent comes from residential burning of coal, firewood, and dung; and ten percent comes from diesel engines.<sup>13</sup> For this reason, the worldwide BC problem rests largely on developing nations.

## PROBLEMS WITH BLACK CARBON

BC causes a variety of health problems if inhaled, including lung disease, asthma, heart disease, and cancer.<sup>14</sup> The estimated health cost of particulate pollution in industrialized countries ranges from U.S. \$200,000 to \$2.75 million per ton, per year.<sup>15</sup> Further perspective is given by a figure released by the World Health Organization that air pollution accounts for the deaths of 2.7 million people annually.<sup>16</sup>

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Atmospheric BC also affects weather patterns. Unlike greenhouse gasses, which trap heat rising from the earth's surface, atmospheric BC, visible as haze or smog, or incorporated into clouds, absorbs incoming sunlight due to its dark color. BC has the effect of cooling regions directly below it while increasing the net temperature of the earth.<sup>17</sup> These changes in temperature destabilize regional weather patterns.<sup>18</sup> For example, NASA scientists link increasing droughts in northern China and flooding in southern China to atmospheric BC.<sup>19</sup>

BC's role in climate change occurs on two levels. Directly, BC's dark coloration absorbs heat that would otherwise escape the atmosphere into space.<sup>20</sup> BC also has several indirect contributory effects. Atmospheric BC can be incorporated into clouds, darkening them, and causing them either to absorb the 40 to 90 percent of solar radiation that they would otherwise reflect<sup>21</sup> or to overheat and burn away entirely.<sup>22</sup> Either result prevents clouds from keeping the planet cool.<sup>23</sup> Unlike CO<sub>2</sub>, which can stay in the atmosphere for 50 to 200 years, BC only stays aloft for a few weeks or months.<sup>24</sup> Unfortunately, once out of the air, BC can collect on ice, snow, mountains, and glaciers.<sup>25</sup> The darkened snow and ice have a reduced albedo, or reflectivity, resulting in faster melting and less sunlight reflected out of the atmosphere.<sup>26</sup> Including all the different ways BC interferes with Earth's heat loss, experts estimate that BC causes more than 25 percent of all observed global warming. When combined with methane ("CH<sub>4</sub>") and other pollutants, these particulates account for at least as much global warming as CO<sub>2</sub>.<sup>27</sup>

### THE KYOTO PROTOCOL

The Kyoto Protocol is an international agreement made under the UNFCCC at the third Conference of the Parties<sup>28</sup> whereby 165 member nations agreed to reduce their emissions of CO<sub>2</sub> and other greenhouse gases.<sup>29</sup> Under the Kyoto Protocol, developed member nations agree to reduce their greenhouse gas emissions by an average of five percent below their 1990 emission levels.<sup>30</sup> Developing nations do not have to reduce their emissions, but can participate in the Clean Development Mechanism ("CDM"). The CDM enables developed member countries to invest in emission-reducing programs in developing countries in exchange for credits that count towards their emission reduction goals.<sup>31</sup> Although many national governments agreed to address climate change at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, the Kyoto Protocol is the first international agreement to protect the environment that is actually binding and enforceable.<sup>32</sup> BC emissions were not considered under the Kyoto Protocol, largely due to a lack of understanding at the time about the role that aerosolized BC plays in accelerating climate change.<sup>33</sup>

Recently, the United Nations Intergovernmental Panel on

Climate Change released the results of a six-year study of global warming.<sup>34</sup> The study shows average global temperatures could rise by 1.5 to 5.8 degrees Celsius within this century, and that the changes are 90 percent likely to have been caused by human activity.<sup>35</sup> To prevent or mitigate permanent environmental damage, a strong, effective international effort will be necessary. Currently, the Kyoto Protocol is the only binding international agreement reflecting the world's reaction to this problem.<sup>36</sup> With the Protocol set to expire in 2012, the issue of whether or not the agreement is irredeemably flawed by not regulating BC is critically important.

### THE ARGUMENT FOR INCLUDING BLACK CARBON IN THE KYOTO PROTOCOL

#### BLACK CARBON SIGNIFICANTLY CONTRIBUTES TO CLIMATE CHANGE

The primary argument that the Kyoto Protocol mishandles global warming lies in the fact that BC contributes significantly to global warming, but is not addressed by the Protocol's terms. Stanford University Professor Mark Z. Jacobson states that reducing BC levels "may slow global warming more than may

any emission reduction of CO<sub>2</sub> or CH<sub>4</sub> for a specific period."<sup>37</sup> Studies conducted by Jacobson and others show that BC warms air much more than CO<sub>2</sub> does, per square unit.<sup>38</sup> Ignoring BC could be dangerous, because even though BC is less common in the atmosphere than carbon dioxide, governments could do more harm than good if they increase the release rate of BC in their attempts to decrease CO<sub>2</sub> emissions. For example, tax

laws in the European Union ("EU") favor diesel vehicles<sup>39</sup> because they get 25 to 35 percent better mileage while emitting less carbon dioxide than gasoline cars.<sup>40</sup> But diesel vehicles release much more BC than gasoline vehicles.<sup>41</sup> If the Bush Administration and Jacobson are correct, the Kyoto Protocol resulted in European policies that may actually encourage global warming.

#### REDUCING BLACK CARBON EMISSIONS WILL RESULT IN MORE IMMEDIATE EFFECTS

A second argument against a Kyoto Protocol without BC regulations is that BC emission cuts are much more reasonably accomplished, and will result in more immediately noticeable effects.<sup>42</sup> Whereas CO<sub>2</sub> stays in the atmosphere, trapping heat for decades, BC remains aloft for days or weeks at the most.<sup>43</sup> Reduced BC production would have climate and health benefits right away, while lowering CO<sub>2</sub> emissions will not have noticeable effects for decades.<sup>44</sup> A notable proponent of this argument is Dr. James Hansen, head of the Goddard Institute for Space Studies at NASA. He believes that CO<sub>2</sub> cuts are unreasonable for modern society whereas BC reductions can easily be achieved

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*Black carbon's dark coloration absorbs heat that would otherwise escape the atmosphere into space.*

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with current technologies.<sup>45</sup> Reducing BC, Hansen says, would give policy-makers a much easier sell to their constituents, who could appreciate the tangible benefits of reducing BC in their daily lives.<sup>46</sup> Moreover, countries like China, exempt under the Kyoto Protocol as a developing nation, *could* be required to meet BC reduction standards, because the technology to do so is available and affordable. Reducing BC would also improve societal health.<sup>47</sup> Hansen argues that it would be better to resume focusing on CO<sub>2</sub> emissions in the future, when technology will allow for realistic and significant CO<sub>2</sub> emission reductions.<sup>48</sup>

### THE PROBLEMS WITH ADDING BC REGULATIONS TO THE KYOTO PROTOCOL

#### A COMPLICATED SCENARIO

Despite the role that BC plays in climate change, and despite the benefits to reducing BC emissions, there are a few problems with declaring the Kyoto Protocol a failure based on the BC issue. For one, BC and other contributory substances have extraordinarily complex interactions which are not yet completely understood.<sup>49</sup> For example, BC is virtually always accompanied by organic carbon (“OC”), a white soot-like substance that reflects light and heat away from the earth and protects clouds and glaciers from the effects of BC darkening.<sup>50</sup> While most scientists agree that substances like BC should be reduced wherever possible, no one yet knows how much OC offsets the problems caused by BC.<sup>51</sup> By contrast, scientists have clearly established that CO<sub>2</sub> produces more global temperature increase than any other substance, including BC.<sup>52</sup> Therefore, reducing CO<sub>2</sub> emissions should be the primary focus because its role in climate change is so prominent and so clearly understood.<sup>53</sup> Even though the Kyoto Protocol does not address BC, the agreement has already begun to see progress in reducing CO<sub>2</sub> emissions worldwide.

#### LOGISTICAL ISSUES

While the EU might be misguided in their encouragement of diesel engines, the practice has worked to reduce net EU CO<sub>2</sub>

emissions. Revamping regulations now might do more harm in terms of CO<sub>2</sub> emissions than good in terms of BC output. Similarly, the areas where BC is produced in the highest quantities (developing countries) are also areas where emissions quotas would be difficult, if not impossible, to meet.<sup>54</sup> True, cities produce a great deal of BC, but comparatively, the planet’s highest producers of atmospheric BC are poor populations in China, India, South America, and the former Soviet Union who use domestic wood burning stoves for cooking and heating and utilize slash and burn agricultural techniques.<sup>55</sup> In countries where older technologies for heating, cooking, and land-clearing prevail, efforts to address BC issues are unlikely. By contrast, focusing on CO<sub>2</sub> has the advantage of requiring the most from those with the most capacity to reduce emissions today: developed nations.

### CONCLUSION

The Kyoto Protocol is not “fatally flawed,” nor is it perfect. BC is a large contributor to climate change. However, CO<sub>2</sub> is as much, if not more, of a factor as well. Ideally, the international community would work together to reduce output of both. Unfortunately, international agreements are difficult to initiate and complex to enforce. In this context, the ratification of a binding agreement which imposes costs on participating nations in the short-term is a highly respectable achievement in its own right. Incorporating BC regulations into the Kyoto Protocol is an excellent idea — provided that member nations would actually comply with them, and that such requirements would not hamper the larger goal of reducing the number one long-term cause of global warming, CO<sub>2</sub>. Success will come with worldwide consensus that a BC problem exists and that the countries best equipped to handle the issue should take the lead in addressing it. The processes that affect climate change are complicated. Any effort to address the problem, even one that does not account for absolutely every factor, should be commended rather than discounted.



## Endnotes: The Big Black Hole in the Kyoto Protocol

<sup>1</sup> Press Release, President Bush Discusses Global Climate Change (June 11, 2001), available at <http://www.whitehouse.gov/news/releases/2001/06/20010611-2.html> (last visited Feb. 5, 2007) [hereinafter Bush].

<sup>2</sup> Bush, *id.*

<sup>3</sup> Kyoto Protocol to the United Nations Framework Convention on Climate Change art. 3(1), Dec. 10, 1997, 37 I.L.M. 22.

<sup>4</sup> UNFCCC website, Parties to the Kyoto Protocol, <http://maindb.unfccc.int/public/country.pl?group=kyoto> (last visited Feb. 5, 2007).

<sup>5</sup> Bush, *supra* note 1.

<sup>6</sup> Bush, *supra* note 1.

<sup>7</sup> Press Release, Despite Lower Carbon Dioxide Emissions, Diesel Cars May Promote More Global Warming than Gasoline Cars (Oct. 21, 2002), available at [http://www.agu.org/sci\\_soc/prri/prri0233.html](http://www.agu.org/sci_soc/prri/prri0233.html) (last visited Feb. 13, 2007) [hereinafter Diesel Cars].

<sup>8</sup> Goddard Space Flight Center, *Black Carbon Contributes to Droughts and Floods in China*, Sept. 26, 2002, available at <http://www.gsfc.nasa.gov/>

[topstory/20020822blackcarbon.html](http://topstory/20020822blackcarbon.html) (last visited Feb. 13, 2007).

<sup>9</sup> Eric Redman, *A Dirty Little Secret: Soot: The Carcinogenic, Climate-Changing Grime No One Talks About*, JUN LEG. AFF., May/June 2005, at 49.

<sup>10</sup> Goddard, *supra* note 8; see generally BurningIssues.org, A Project of Clean Air Revival, Inc., <http://burningissues.org> (last visited Feb. 5, 2007).

<sup>11</sup> The Oregonian, *Black Carbon Major Suspect in Warming Trend* (Nov. 24, 2006) available at <http://www.oregonlive.com/printer/printer.ssf?base/news/1164007549115190.xml> (last visited Feb. 5, 2007).

<sup>12</sup> Goddard, *supra* note 8.

<sup>13</sup> Redman, *supra* note 9, at 49.

<sup>14</sup> BurningIssues.org, *supra* note 10.

<sup>15</sup> Diesel Cars, *supra* note 7.

<sup>16</sup> Diesel Cars, *supra* note 7.

<sup>17</sup> Oregonian, *supra* note 11.

## ENDNOTES: THE BIG BLACK HOLE IN THE KYOTO PROTOCOL *continued from page 62*

<sup>18</sup> Oregonian, *supra* note 11.

<sup>19</sup> Goddard, *supra* note 8.

<sup>20</sup> Goddard, *supra* note 8.

<sup>21</sup> James Hansen et al., *Global Warming in the Twenty-First Century: An Alternative Scenario*, 97 PROCEEDINGS NAT. ACADEMY SCI. 9875, 9880 (2000).

<sup>22</sup> Chien Wang, MIT Joint Program on the Science and Policy of Global Change, *A Modeling Study on the Climate Impacts of Black Carbon Aerosols*, (March 2002) available at [http://web.mit.edu/globalchange/www/MITJP-SPGC\\_Rpt84.pdf](http://web.mit.edu/globalchange/www/MITJP-SPGC_Rpt84.pdf) (last visited Feb. 5, 2007).

<sup>23</sup> Andrew C. Revkin, *Debate Rise Over a Quick(er) Climate Fix*, N.Y. TIMES, Oct. 3, 2000, available at <http://www.nytimes.com/2000/10/03/science/03GREE.html> (last visited Feb. 5, 2007).

<sup>24</sup> Diesel Cars, *supra* note 7.

<sup>25</sup> James Hansen & Larissa Nazarenko, *Soot Climate Forcing via Snow and Ice Albedos*, 101 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 423 (Jan. 2004).

<sup>26</sup> CBS News, *Soot Blamed For Global Warming* (Dec. 23, 2003), available at <http://www.cbsnews.com/stories/2003/12/23/tech/main589926.shtml> (last visited Feb. 13, 2007).

<sup>27</sup> Redman, *supra* note 9, at 49.

<sup>28</sup> Kyoto Protocol, *supra* note 3.

<sup>29</sup> Kyoto Protocol, *supra* note 3.

<sup>30</sup> Kyoto Protocol, *supra* note 3.

<sup>31</sup> Kyoto Protocol, *supra* note 3.

<sup>32</sup> Reuters, *What is the Kyoto Protocol* (Jan 30, 2007), available at [http://today.reuters.co.uk/news/articlenews.aspx?type=topNews&storyid=2007-01-30T072036Z\\_01\\_HO026384\\_RTRUKOT\\_0\\_TEXT0.xml&src=013007\\_0327\\_DOUBLEFEATURE\\_environment](http://today.reuters.co.uk/news/articlenews.aspx?type=topNews&storyid=2007-01-30T072036Z_01_HO026384_RTRUKOT_0_TEXT0.xml&src=013007_0327_DOUBLEFEATURE_environment) (last visited Feb. 5, 2007).

<sup>33</sup> Mark Z. Jacobson, *Control of Fossil-Fuel Particulate Black Carbon and*

*Organic Matter, Possibly the Most Effective Method of Slowing Global Warming*, 107 J. OF GEOPHYSICAL RES. 16.1 (2002), available at <http://www.stanford.edu/group/efmh/fossil/fossil.pdf> (last visited Feb. 3, 2007).

<sup>34</sup> The Guardian, *Scientists Offered Cash to Dispute Climate Study* (Feb. 2, 2007), available at <http://www.guardian.co.uk/international/story/0,,2004230,00.html?gusrc=rss&feed=11> (last visited Feb. 13, 2007).

<sup>35</sup> The Guardian, *id.*

<sup>36</sup> Greenpeace.org, About the Kyoto Protocol, *Debate Rise Over a Quick(er) Climate Fix*, <http://www.greenpeace.org/australia/issues/climate-change/solutions/political/kyoto-protocol> (last visited Feb. 5, 2007).

<sup>37</sup> Jacobson, *supra* note 33.

<sup>38</sup> Diesel Cars, *supra* note 7.

<sup>39</sup> Jacobson, *supra* note 33.

<sup>40</sup> Diesel Cars, *supra* note 7.

<sup>41</sup> Diesel Cars, *supra* note 7.

<sup>42</sup> Revkin, *supra* note 23.

<sup>43</sup> Redman, *supra* note 9.

<sup>44</sup> Redman, *supra* note 9.

<sup>45</sup> Revkin, *supra* note 23.

<sup>46</sup> Revkin, *supra* note 23.

<sup>47</sup> Oregonian, *supra* note 11.

<sup>48</sup> Oregonian, *supra* note 11.

<sup>49</sup> Oregonian, *supra* note 11.

<sup>50</sup> Redman, *supra* note 9.

<sup>51</sup> Redman, *supra* note 9.

<sup>52</sup> Bush, *supra* note 1.

<sup>53</sup> Hansen & Nazarenko, *supra* note 25.

<sup>54</sup> Redman, *supra* note 9.

<sup>55</sup> David Streets and Tami Bond, *The Emergence of Black Carbon into the Climate Policy Arena*, American Geophysical Union, (Spring 2002), available at <http://adsabs.harvard.edu/abs/2002AGUSM.A42C..02S> (last visited Feb. 5, 2007).