CENTER *for* BIOLOGICAL DIVERSITY

VIA UPLOAD TO DOCKET NO. NHTSA-2014-0074 at REGULATIONS.GOV
And hardcopy of comments with CD of references submitted via U.S. Mail

August 8, 2014

National Highway Traffic Safety Administration
Docket Management Facility, M-30
U.S. Department of Transportation
West Building, Ground Floor, Rm. W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590
Attn: NHTSA-2014-0074

Re: Notice of Intent to Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program Standards, 79 Fed. Reg. 38842 (July 9, 2014); Docket No. NHTSA-2014-0074

The Center for Biological Diversity (the "Center") submits the following comments in response to the Notice of Intent to Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program, 79 Fed. Reg. 38842 (July 14, 2014, Docket No. NHTS-2014-0074 issued by the National Highway Traffic Safety Administration ("NHTSA"). The Center for Biological Diversity ("Center") is a non-profit organization with more than 775,000 members and online activists and offices throughout the United States. The Center's mission is to ensure the preservation, protection and restoration of biodiversity, native species, ecosystems, public lands and waters and public health. In furtherance of these goals, the Center's Climate Law Institute seeks to reduce U.S. greenhouse gas emissions and other air pollution to protect biological diversity, the environment, and human health and welfare. Specific objectives include securing protections for species threatened by global warming, ensuring compliance with applicable law in order to reduce greenhouse gas emissions and other air pollution, and educating and mobilizing the public on global warming and air quality issues. These comments are filed on behalf of our members and staff with a vital interest in reducing greenhouse gas and other air pollutants.

We fully support NHTSA's effort to curb greenhouse gas ("GHG") emissions from new medium- and heavy-duty on-highway vehicles and work trucks ("MD/HD Vehicles") and appreciate the opportunity to submit comments on the forthcoming draft Environmental Impact Statement ("EIS") that will accompany the agency's rulemaking. We trust that in light of the

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indisputable scientific evidence now at the agency's disposal, NHTSA will undertake the task of preparing the EIS and the standard-setting with a sense of urgency, understanding that only the most stringent alternative within the range of technically feasibility and cost-effectiveness can be adequate to tackle the climate crisis that is upon us. We also hope that these comments may assist the agency in avoiding flaws in the first Medium- and Heavy-Duty Fuel Efficiency Improvement Program Final Environmental Impact Statement (June 2011) and subsequent final rulemaking in Phase I of the program for these vehicles.

At the outset, we note that NHTSA appears to be late in commencing the process of preparing an EIS report and setting standards for MD/HD Vehicles manufactured after 2018. As the agency states, a provision of the Energy Independence and Security Act, 42 U.S.C. § 32902(k)(2) and (3) ("EISA"), requires that the standards adopted must provide not less than four model years of lead time before new standards take effect. Yet, the agency currently intends to finalize the next rulemaking as late as March 31, 2016,[1] which appears to preclude the new standards from affecting vehicles built before model year 2021. This would leave the current, overly lax Phase I rulemaking for MD/HD Vehicles in effect for an additional model year (2020). If this calculation is correct, we urge NHTSA to speed up the current process so that the final substantive rule is issued in 2015 and thus can be implemented for model year 2020.

In 2007, the CO_2 emissions from U.S. MD/HD Vehicles constituted 24.8 percent of all greenhouse gas emissions from motor vehicles and engines, the fastest growing source of U.S. greenhouse gas emissions since 1990.[2] Because these emissions are closely related to the amount of fuel the vehicles consume, setting fuel efficiency standards at the maximum feasible level is among the most significant single actions the U.S. government can take to reduce America's overall greenhouse gas emissions. Thus, it is imperative that the forthcoming EIS fully and effectively disclose the consequences of the proposed actions and present and evaluate them in a manner that allows the decision-makers and the public to understand, analyze and compare their impacts in the context of the role MD/HD Vehicle fuel efficiency play in combating climate change. Specifically, we note the following:

- The science that NHTSA has indicated will guide its action shows unequivocally that climate change is already upon us, and that its consequences, if not mitigated within the next few decades, will be exorbitantly expensive, irreversible, permanent, and catastrophic. Because there is no doubt that we cannot exceed our remaining carbon budget if those consequences are to be avoided, the most stringent alternative within a range of maximum feasible fuel economy improvements must be implemented as quickly as possible.
- NHTSA should analyze the alternatives it discusses in a manner that does not artificially minimize the true impact the more stringent alternatives can have by misleadingly depicting their impact as negligible.
- NHTSA should analyze and discuss an alternative that accounts for and avoids, or

[1] 79 Fed. Reg. 33844/1.

[2] Fact Sheet, EPA and NHTSA to Propose Greenhouse Gas and Fuel Efficiency Standards for Heavy Duty Trucks, EPA-420-F-10-038 (May 2010); U.S. EPA, 2009 Technical Support Document for Endangerment and Cause or Contribute Findings on Greenhouse Gases under Section 202(a) of the Clean Air Act at 181, *available at* http://www.epa.gov/climatechange/endangerment/

minimizes the likelihood, of reaching additional climate change tipping points.

- NHTSA should analyze and discuss alternatives that contribute to the reduction of greenhouse gas emissions from MD/HD Vehicles to levels that allow the U.S. to reduce its overall emissions to sustainable levels. In particular, the MD/HD Vehicle environmental impact statement ("EIS") should include an analysis of the extent to which each of the proposed alternatives would contribute proportionally to staying within the carbon budget, and of the extent to which it accomplishes a reduction of U.S. greenhouse gas emissions to 17% below 2005 levels by 2020 (as pledged by the President),[3] to 25- 40% below 1990 levels by 2020 and to 80% below 1990 levels by 2050, and also project results through 2080 and 2100.
- NHTSA must present alternatives that are "technology forcing."
- NHTSA should conduct a cost-benefit analysis that properly accounts for all of the damages caused by climate change and that recognizes that mitigation costs will sharply increase over time, and adjust its concept of what is in fact cost-effective accordingly.

I. Recent Scientific Evidence Demonstrates that Climate Change Is Already Upon Us and that its Harms Are Substantially Greater, and Impacts More Immediate, Than Previous Rulemakings Have Assumed

NHTSA states that in assessing the impacts of MD/HV Vehicle greenhouse gas emissions on climate change and analyzing various alternatives to curb such emissions, it intends to rely primarily on the IPCC Fourth Assessment Report ("ICCP AR4"), the IPCC Fifth Assessment Report ("ICCP AR5"), the U.S. Global Change Research Program ("USGCRP"), including the USGCRP Third National Climate Assessment ("NCA)" Report, the National Academies and National Research Council assessments of climate impacts and the EPA Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act and accompanying Technical Support Documents (the "Endangerment Finding").[4] We fully agree that ICCP AR5, the USGCRP, the NCA and the National Academies and National Research Council assessments of climate change are the most comprehensive and among the most recent summaries available, and we stress that the EIS and the agency's actions must reflect and respond to the absolute urgency demonstrated by these scientific assessments. Some of the data underpinning the Endangerment Finding, however, have been superseded by data showing that the dangers of climate change are both much more dire and immediate than expressed there. The same is true of the ICCP AR4 where it has been superceded or refined by the ICCP AR5. NHTSA may not rely on any outdated information, and it may not be out of step with the reports, studies and scientific assessments prepared by the Obama Administration itself.

Because NHTSA has identified the science that must guide its rulemakings, and because we anticipate that the agency itself will see its obligations in setting carbon emission standards for MD/HD Vehicles in an entirely new light, we here provide only a short summary of what that

[3] Stern, Todd, Letter from Todd Stern, U.S. Special Envoy for Climate Change to Mr. Yvo de Boer, Executive Secretary of the U.N. Framework Convention on Climate Change re: associating with the CopenhagenAccord, Office of the Special Envoy for Climate Change (January 28, 2010) (Letter to U.S. Special Envoy 2010), a*vailable at* http://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/unitedstatescphaccord_app.1.pdf.
[4] 79 Fed. Reg. 38847/1.

science says and means.[5] The evidence that our climate is already changing—and that anthropogenic emissions are a primary cause—has only continued to mount and is beyond doubt.[6] The first installment of the IPPC AR5, covering the physical science basis of climate change, makes clear that "[w]arming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia."[7] The report also concludes that it is "extremely likely"—meaning at least 95% certain—that "human influence has been the dominant cause of the observed warming since the mid-20th century."[8] Action to address this warming is urgent. The NCA states unequivocally that "reduc[ing] the risks of some of the worst impacts of climate change" will require "aggressive and sustained greenhouse gas emission reductions" over the course of this century.[9]

As the IPPC AR5 recognizes, climate is changing more quickly than projected by earlier IPCC reports; climate impacts are occurring at lower surface temperatures than previously estimated; temperature change and sea level rise during this century will be greater than previously projected; and the climate is approaching tipping points beyond which the climate system will switch to a different state more quickly than previously projected.[10] At least one tipping point – the rapid disappearance of late-summer Arctic sea ice – has already been crossed.[11] Another, the irreversible melting of portions of the Antarctic ice sheet, is very likely

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[5] We have previously commented on the agency's environmental impact reports and rulemakings, and hereby incorporate those comments by reference and attach them hereto. They include Comments by the Center re: Final Environmental Impact Statement, Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2021-2016 (February 2010); Docket No. NHTSA-2009-0059 (March 25, 2010) as Attachment A; Comments by the Center re: Notice of Intent To Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program, 75 Fed. Reg. 33565 (June 14, 2010); Docket No. NHTSA-2010-0079 (July 14, 2010) as Attachment B; Comments by Center re: Draft Environmental Impact Statement, Medium- and Heavy-Duty Fuel Efficiency Improvement Program (October 2010); Docket No. NHTSA-2010-0079 (January 3, 2010) as Attachment C; Comments by Center re: Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Proposed Rule; Docket Nos. NHTSA-2010-0079 and EPA-HQ-OAR-2010-0162 (January 31, 2011) as Attachment D; Comments by the Center re: Medium- and Heavy-Duty Fuel Efficiency Improvement Program, Final Environmental Impact Statement, June 2011; Docket No. NHTSA-2010-0079 (July 22, 2011) as Attachment E.

[6] A brief summary of current climate science prepared by Center for Biological Diversity scientific staff, and updated as of October 2013, is also attached as Attachment F.

[7] Intergovernmental Panel on Climate Change, *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers* 2 (2013), *available at* http://www.climatechange2013.org/ ("IPCC AR5 WG1 SPM").

[8] IPCC AR5 WG1 SPM at 2 n.2 (explaining term "extremely likely"), 15 (discussing human contribution to observed warming).

[9] Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe, *Climate Change Impacts in the United States: The Third National Climate Assessment*, U.S. Global Change Reseach Program, pp. 14-15 (2014), *available at* http://nca2014.globalchange.gov/downloads.

[10] *See* IPCC AR5; National Research Council, *Abrupt Impacts of Climate Change: Anticipating Surprise*, The National Academies Press (2013), *available at* http://www.nap.edu/catalog.php?record_id=18373; see *also* Fussel, Hans-Martin, *An updated assessment of the risks from climate change based on research published since the IPCC Fourth Assessment Report*, 97 Climatic Change 469-482 (2009); Lenton, Timothy M. et al., *Tipping elements in the Earth's climate system*, 105 PNAS 1786-1793 (2008); UNEP, *Climate Change Science Compendium 2009*, Catherine P. McMullen and Jason Jabbour, eds. (2009); Richardson, Katherine et al., *Climate Change: Global Risks, Challenges, and Decisions* (2009).

[11] The White House, *Cost of Delaying Action to Stem Climate Change* at 2 (July 29, 2014), *available at* http://www.whitehouse.gov/the-press-office/2014/07/29/white-house-report-cost-delaying-action-stem-climate-change ("Cost of Delay").

to have started as well.[12] It is beyond dispute that several processes delay the full impacts of greenhouse gases and make them extremely long-lasting: (1) the climate commitment (i.e. future warming and sea-level rise resulting from greenhouse gas concentrations that are *already* in the atmosphere); (2) the irreversibility and permanence of damage done by climate change and ocean acidification from CO_2 emissions; (3) the triggering of tipping points; and (4) the enhancement of positive feedback cycles that amplify climate change.[13]

As is apparent from the latest scientific sources NHTSA cites, since the agency has last looked at the issue uncertainty about the effects of climate change and the degree of harm caused by various amounts of future emissions has narrowed to such a degree that what must be done to avert that harm with a reasonable chance of success is now beyond dispute. As the IPCC recognizes, humanity has a remaining "carbon budget" consisting of a known range of carbon that can still be emitted without triggering climate catastrophe. The "carbon budget" necessary to preserve a likely chance of holding the average global temperature increase to no more than 2°C above pre-industrial levels, the internationally agreed-upon target, is known. According to the IPCC, if non-CO_2 forcings are taken into account, *total cumulative future anthropogenic emissions of CO_2 must remain below about 1,000 gigatonnes (Gt) to achieve this goal.* Specifically, the IPCC AR5 states the following:

> Limiting the warming caused by anthropogenic CO_2 emissions alone with a probability of >33%, >50%, and >66% to less than 2°C since the period 1861–1880, will require cumulative CO_2 emissions from all anthropogenic sources to stay between 0 and about 1570 GtC (5760 $GtCO_2$), 0 and about 1210 GtC (4440 $GtCO_2$), and 0 and about 1000 GtC (3670 $GtCO_2$) since that period, respectively. These upper amounts are reduced to about 900 GtC (3300 $GtCO_2$), 820 GtC (3010 $GtCO_2$), and 790 GtC (2900 $GtCO_2$), respectively, when accounting for non-CO_2 forcings as in RCP2.6. An amount of 515 [445 to 585] GtC (1890 [1630 to 2150] $GtCO_2$), was already emitted by 2011.[14]

Some leading scientists – characterizing the effects of even a 2°C increase in average global temperature as "disastrous" – have prescribed a far more stringent carbon budget for coming decades, one that requires phasing out fossil fuel use as quickly as possible and leaving them "in the ground."[15] And according to the NCA, "very deep reductions in future emissions –

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[12] *E.g.*, Rignot, E. et al., *Widespread, Rapid Grounding Line Retreat of Pine Island, Thwaites, Smith and Kohler Glaciers, West Antarctica, From 1992 to 2011,* 41 Geophys. Res. Lett 3502-3509, doi:10.1002/2014GL060140 (May 28, 2014); National Aeronautics and Space Administration, *West Antarctic Glacier Loss Appears Unstoppable* (June 12, 2014), *available at* http://climate.nasa.gov/news/1088/; Rignot, E. et al., *Recent Antarctic Ice Mass Loss from Radar Interferometry and Regional Climate Modeling*, 1 Nature Geoscience (Published online Jan. 18, 2008); M. Mengel, M. and A. Levermann, *Ice Plug Prevents Irreversible Discharge from East Antarctica*, 4 Nature Climate Change (2014)*;* Barnosky, A.D. et al., *Approaching a State Shift in Earth's Biosphere*, 486 Nature 52-58 (2012)*;* Joughin, I., B.E. Smith, and B. Medley, *Marine Ice Sheet Collapse Potentially Under Way for the Thwaites Glacier Basin, West Antarctica*, 344 Science 734-738 (2014).

[13] *See* Attachment B: Comments by the Center re: Notice of Intent to prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program, 75 Fed. Reg. 33565 (June 14, 2010) Docket No. NHTSA-2010-0079 (July 14, 2010), at 3-9.

[14] IPCC AR5 WG1 SPM at 25-26. *See also* United Nations Environment Programme, *The Emissions Gap Report 2013* (Nov. 2013) at 13-22 (describing emissions "pathways" consistent with meeting 2°C and 1.5°C targets).

[15] James Hansen, et al., *Assessing ''Dangerous Climate Change'': Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*, 8 PLoS ONE e81648 at 15 (2013),

ultimately approaching zero," are required because of the existing buildup of CO_2 already in the atmosphere.[16] But even if NHTSA were to discount those reports, the IPCC AR5 now provides a clear range of the upper boundaries of global carbon emissions that cannot be exceeded without taking plainly unacceptable risks.

Moreover, President Obama's Administration now publicly acknowledges the separate and extremely steep costs that attach to *delayed action* alone. As we have consistently pointed out in previous comments, and as the Administration's laudable recent report on the cost of delaying action on climate change[17] demonstrates, this cost is irreversible and permanent, and it rises exponentially as delay continues. Based even on highly conservative assumptions, the report values the cost of *delay alone* as at least $150 billion for *every year* of delayed action if the delay results in overshooting the increase of temperatures over pre-industrial levels by just one degree Celsius, and sharply higher annual amounts for every degree of warming thereafter.[18] Current global carbon emission rates are on a path leading to a projected total warming above pre-industrial temperatures of 4.5° Celsius,[19] resulting in annual costs exceeding the report's boundaries. Plainly, every year of unnecessary delay in setting emission targets sufficiently stringent to meet the challenge at hand, in the face of steeply rising, persistent, and irreversible costs of delay, including the acknowledged possibility that mitigation will be too late,[20] is unreasonable and unjustifiable.

These facts require a new approach by NHTSA to the upcoming EIS: it must act with the sense of urgency appropriate to the situation. It should, among other things, depict the alternatives it selects, and the one it recommends, by explaining to what extent they contribute – or fail to contribute - to a reduction of emissions from MD/HD Vehicles sufficient to keep their emissions over time within the remaining carbon budget of approximately 1,000 GT of CO_2, based on their proportional contribution to overall emissions from (1) all on-road U.S. carbon emissions; (2) all U.S. transportation-related carbon emissions; (3) all U.S. emission; and (4) all global emissions. In projecting cumulative future impacts, the agency should analyze and disclose the comparative effects of its range of alternatives on each of these four emission source groupings, and include a scenario that assumes these other sources will do their proportional part in what is required to remain within the carbon budget – an assumption about U.S. and global mitigation efforts that is now certainly foreseeable in light of the near certainty, expressed in IPCC AR5 and elsewhere and understood around the world, that any other course of conduct triggers irreversible and catastrophic damage.

II. The EIS Should Analyze and Present Alternatives So as Not to Misleadingly Imply That their Impact Is Negligible

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doi:10.1371/journal.pone.0081648, *available at* http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0081648.

[16] J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., *Climate Change Impacts in the United States: The Third National Climate Assessment* at 649 (2014) (emphasis added), *available at* http://nca2014.globalchange.gov/downloads.

[17] Cost of Delay, *supra.*

[18] *Id.*

[19] IPCC AR5 WGI SPM at 14.

[20] *Id.* at 20.

Because NHTSA has indicated that its next EIS will proceed "[s]imilar to past EIS practice,"[21] we here repeat what we believe were critical inadequacies of that prior analysis, and request that NHTSA remedy them.

In particular, in our earlier comment letters to NHTSA, we discussed the manner in which NHTSA presented the effects of the proposed greenhouse gas emission reductions on what it perceived was their foreseeable cumulative result in terms of CO_2 levels, temperature and sea level rise and other consequences. There we noted that a temperature increase of 1.4ºC over 1990 levels (or an increase of 2ºC over pre-industrial levels) would create a fifty/fifty chance that severe and irreversible impacts from global warming will occur (numbers that must now be updated, to a worse result, under IPCC AR5).[22] Yet, all of the agency's various environmental impact reports showed that in the year 2100, even the most stringent alternative presented would result in global CO_2 concentrations of temperature increases of more some 2.6ºC above *today's* level, leading to catastrophic consequences. This leads to an incorrect assessment of highly beneficial results of the most stringent alternative, as it masks its actual impact and wrongly assumes no or much too little action by other emission sectors and other global actors. NEPA and its implementing regulations direct federal agencies to "[u]se the NEPA process to identify and assess the reasonable alternatives to proposed actions that *will avoid or minimize adverse effects of these actions upon the quality of the human environment*," and "[u]se all practicable means . . . to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(e) and (f) (emphasis added). An EIS must correctly depict the reasonably foreseeable outcome of its selected alternatives.[23] The Obama Administration has just recently rejected the canard that U.S. action cannot make a meaningful difference because, allegedly, inaction by the rest of the world will inevitably undermine that effort: "Climate change is a global problem, and it will require strong international leadership to secure cooperation among both developed and developing countries to solve it. America must help forge a truly global solution to this global challenge by galvanizing international action to significantly reduce emissions. By taking credible steps toward mitigation, the United States will also reap the

[21] 79 Fed. Reg. 38846/3.

[22] At the time we cited Joel B. Smith et al., *Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) "Reasons for Concern,"* Proc. of the Nat'l. Acad., SCL (Feb. 26, 2009) at 1, 5; Parry, M.L., et al., Technical Summary. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 23-78 (2007) at 11.

[23] The Light Duty Vehicle FEIS' analysis did serve to prove that the Light Duty Vehicle Rule's greenhouse gas reductions are insufficiently stringent. But the manner in which this conclusion was presented also created the incorrect impression that the environmental outcome would not change regardless of what course of action the agencies pursued. When the difference in the effects of all alternatives presented amounts to no more than mere single digits in parts per million of CO_2 concentrations or even fractions of a single digit in temperature and sea level rise, it appears that efforts to improve fuel efficiency beyond what the agency has selected would be futile and irrelevant. This line of reasoning is not far from what the Supreme Court condemned in *Massachusetts v. EPA*, when it took EPA to task for characterizing achievable greenhouse gas reduction measures as insignificant. *Massachusetts v. EPA*, 549 U.S. 497, 523-26 (2007). Thus, we request that in the forthcoming EIS, NHTSA refrain from justifying any decision not to demand truly maximum feasible fuel efficiency by depicting the ultimate outcome of all regulatory efforts as *de minimis*, and instead conduct a meaningful alternative analysis as suggested herein.

benefits of early action."[24] In other words, because U.S. leadership will act as the catalyst for international agreement, there is nothing futile about the United States reducing its own emissions by an amount commensurate and proportional to the problem.

Thus, NHTSA should perform an analysis that shows what it must do to curb emissions from MD/HD Vehicles that proportionally contribute to reaching sustainable emissions targets. As stated above, this requires that the alternatives' relative impacts in terms of emission reductions are shown as compared to (1) all on-road U.S. carbon emissions; (2) all U.S. transportation-related carbon emissions; (3) all U.S. emission; and (4) all global emissions; and that NHTSA, in projecting cumulative future impacts, include a scenario that assumes these other emission sources will do their proportional part in what is required to remain within the carbon budget. NEPA and CEQ implementing regulations require NHTSA to consider the foreseeable actions of others: "CEQ regulations implementing the procedural provisions of NEPA define cumulative impacts as 'the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions.' 40 CFR 1508.7." While currently enacted regulations and the future policies and promises of third parties remain inadequate to address the problem, a different outcome – one that does tackle the problem as it must be tackled – is foreseeable. Because the amount of carbon that can still be emitted before unacceptable risks become inevitable is known here and in the international community, and in light of the increasing clamor for action on the international scale, it is at least as foreseeable that sufficient action will be taken than that it will not.

III. The EIS Should Analyze What Must Be Done to Cut Emissions From MD/HD Vehicles to a Sustainable Level

We thus request that NHTSA perform a back-casting analysis of alternative fuel efficiency standards that measures what constitutes a "maximum feasible" standard against what climate science dictates must be accomplished, focusing on the U.S.' proportionate responsibility for cutting emissions from this source, and indicating the remaining gaps. Specifically, NHTSA should determine the total greenhouse gas emissions reductions from MD/HD Vehicles that would allow the sector to stay within its proportionate share of the remaining carbon budget of approximately 1,000 GT of CO_2, thereby avoiding known and intolerable levels of risk. The agency should then assess how close to those reductions a maximum feasible standard can come. We also request that the MD/HD Vehicle EIS include an analysis of the extent to which the proposed alternatives would contribute to a reduction of U.S. greenhouse gas emissions to 17% below 2005 levels by 2020 (as pledged by the President),[25] to 25- 40% below 1990 levels by 2020 and to 80% below 1990 levels by 2050, and also project results through 2080 and 2100.

We disagree with NHTSA's proposal that it analyze impacts on fuel/energy use and pollutant emissions through 2050 only, instead of through 2060 as it has done before. NHTSA's justification for this proposed change is that "HD vehicles generally accumulate the vast majority of their VMT in early years, and . . . more distant projections contain more uncertainty."[26]

[24] Cost of Delay, *supra*, at 7.
[25] Letter to U.S. Special Envoy 2010.
[26] 79 Fed. Reg. 38846/3.

However, the cited justifications are unsound. The latter objection is simply a truism applicable to whatever period of future projections NHTSA might pick – and inconsistent with NHTSA's approach for greenhouse gases. The former objection ignores the fact that new HD vehicles are built and bought all the time, and therefore a more or less constant flow of new HD vehicles continuously adds the "vast majority of their VMT" to the mix. NHTSA should continue its projections through 2060.

IV. NHTSA Should Perform An Unbiased Cost-Benefit Analysis

In its prior comments,[27] the Center demonstrated that NHTSA's assumptions concerning costs and benefits were skewed against reaching the truly maximum feasible fuel efficiency standards that are mandated by law. In general, NHTSA systematically undercounted the enormous benefits resulting from increased fuel efficiency and overestimated the costs. In any event, NHTSA's rulemakings never resulted in a situation where these undercounted benefits even began to equal the overestimated costs. The social cost of carbon was too low, discount rates too high, payback periods too short, the cost of delay was not sufficiently accounted for, and NHTSA failed to assess the cost of, much less require, shorter vehicle redesign cycles. These comments are incorporated here by reference with the request that NHTSA avoid these issues in the forthcoming EIS. In addition, the scientific studies and summaries such as IPCC AR5 that NHTSA will now use as the basis for its conclusions demonstrate conclusively that the economic, environmental, social and other benefits of avoiding the effects of climate change have been severely understated as climate change effects have occurred sooner than anticipated, that tipping points are likely to occur within decades and not centuries and some have occurred already, that climate commitment already exposes the Earth to irreversible effects, and that mitigation costs are permanent, persistent and irreversible, and increase exponentially – to the point that mitigation may be no longer possible – the longer they are delayed.

In addition, the social cost of carbon estimates continue to underestimate the true costs of carbon pollution. That cost is "an estimate of the economic damages associated with a small increase in carbon dioxide (CO_2) emissions, conventionally one metric ton, in a given year."[28] The carbon cost figure "also represents the value of damages avoided for a small reduction (i.e. the benefit of a CO_2 reduction)."[29] In 2013, the Interagency Working Group on the Social Cost of Carbon proposed to update social cost of carbon estimates.[30] Its proposal indicates that by 2020, carbon costs could be as high as $128/ton of carbon dioxide. Even that estimate is low as demonstrated by other comments and studies on the subject.[31] NHTSA cannot rely on outdated

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[27] *E.g.*, Comments by the Center re: Proposed Rulemaking To Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Proposed Rule, 74 Fed. Reg. 49454 (Sept. 28, 2009); EPA Docket ID No. EPA-HQ-OAR-2009-0472; NHTSA-2009-0059 (Nov. 27, 2009).

[28] *See* U.S. Environmental Protection Agency, "The Social Cost of Carbon," *available at* http://www.epa.gov/climatechange/EPAactivities/economics/scc.html (last accessed August 8, 2014).

[29] *Id.*

[30] *See* Interagency Working Group on the Social Cost of Carbon, United States Government, *Technical Support Document: Technical Update on the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* (May 2013, revised November 2013), *available at* http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf.

[31] *E.g.*, Peter Howard, *Omitted Damages: What's Missing From the Social Cost of Carbon* (March 13, 2014); Richard Revesz, Peter Howard et al., *Global Warming: Improving Economic Models of Climate Change*,

data and must at least follow the current working group proposal, and/or should perform its own calculations based on the information contained in the IPCC AR5 and other studies, and also take into account the separate costs of delay calculated by the Administration in its recent study on the subject, noting, however, that those estimates, according to the study itself, still "*understate* the true cost of delaying action to mitigate climate change."[32]

In short, the costs of climate change are enormous, while the costs of implementing fuel efficiency regulations for MD/HV Vehicles are negligible by comparison. NHTSA should not exclude the use of fuel efficient technology based on incorrect, biased, and extremely dangerous cost-benefit conclusions.

V. NHTSA Should Present Alternatives That Are Truly Technology Forcing

In Phase I, NHTSA decided against requiring many fuel-efficient and cost-effective technologies, even though they were either already available or in an advanced stage of research or design; as a result, the current MD/HD Vehicle rules allow these vehicles to continue to operate at much less than maximum feasible fuel efficiency. We directed the agency's attention to a number of available technologies during Phase I in our comments.[33] These included, among others, fuel efficiency regulations for trailers used with Class 7 and Class 8 tractors; bottoming cycle technology; aggressive aerodynamics and rolling resistance reductions; advanced tire technologies; parallel hybrid powertrains; light weighting; 60 mile-per-gallon governors; idle reduction technologies; advanced exhaust gas recirculation; electric vehicle technology; use of double trailers; and the requirement that each, and not just some, of these proven, available, and technically feasible and cost-effective fuel efficiency measures should be implemented. There were few valid reasons for rejecting any of these technologies in 2011, and there are none now. In particular, it was an egregious omission to devise no requirements at all for commercial trailers, even though the agency itself noted that aerodynamic and tire rolling resistance improvements represented significant opportunities to reduce fuel consumption and greenhouse gases by up to 65%. The agency also exempted certain vehicles altogether, such as off-road tractors, vocational body manufacturers, and fleet owners and truck owner/operators without adequate explanation. The agency allowed legacy diesel engines to adopt lower standards as a "glide path" because of an allegedly short period time for compliance. No such leniency can be appropriate now, and exemptions and exclusions must be eliminated. The agency also failed to adopt some of the recommendations of the then-current NAS Report, and failed to convert proven, cost-effective and in-use fuel efficiency measures used under the Smart Way program into regulatory requirements. We urge NHTSA to correct these flaws in its upcoming

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NatureNews (Apr. 4, 2014), http://www.nature.com/news/global-warming-improve-economic-models-of-climate-change-1.14991; Ackerman, F., and E. Stanton, *The Social Cost of Carbon*, A REPORT FOR THE ECONOMICS FOR EQUITY AND THE ENVIRONMENT NETWORK (2010), *available at* www.e3network.org/papers/SocialCostOfCarbon_SEI_20100401.pdf.

[32] Cost of Delay, *supra,* at 9 (emphasis added).

[33] Attachment C: Comments by Center re Draft Environmental Impact Statement, Medium- and Heavy-Duty Fuel Efficiency Improvement Program, October 2010; Docket No. NHTSA-2010-0079 (January 3, 2010); Attachment D: Comments by Center re Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Proposed Rule; Docket Nos. NHTSA-2010-0079 and EPA-HQ-OAR-2010-0162 (January 31, 2011); Attachment E: Comments by Center re Medium- and Heavy-Duty Fuel Efficiency Improvement Program, Final Environmental Impact Statement, June 201; docket No. NHTSA-2010-0079 (July 22, 2011).

rulemaking.

In particular, we draw the agency's attention to the explosive technological advances that have taken place or are in advanced research and design phases in the electric vehicle industry. Vehicle manufacturers are already bringing new large electrified trucks and SUVs to market. The transition from there to incorporating many electric vehicle technologies into some of the vehicle classes subject to the current rulemaking is not difficult, certainly not within the time span of this rulemaking. We urge the agency to include full, hybrid or partial electrification of MD/HD Vehicles wherever possible as part of the Phase II requirements.

We note that NHTSA and EPA rejected measures such as the 60-mile-per-gallon governors as purportedly outside of their statutory power. In light of EPA's recently proposed rulemaking for existing power plants under section 231 of the Clean Air Act, in which it proposes measures such as energy conservation by consumers that *reduce emissions by curbing the need for electricity generation in the first place*, there can be no obstacle to similar measures here that are immediately available and highly cost-efficient while lowering fossil fuel consumption and thus greenhouse gas emissions. We encourage both agencies to explore the many ways in which such measures can be integrated into Phase II of the program.

VI. Other Comments

The Center requests that any decisions concerning natural gas-powered vehicles be based on a full lifecycle analysis that employs correct metrics. The National Research Council has already pointed out that "[t]he GH impact of methane leakage during gas extraction or other parts of the life cycle could negate the inherent tailpipe CO2 advantage of natural gas."[34] This assessment, however, is based on incorrect values of the global warming potential ("GWP") of methane as well as its leakage rate. The IPCC AR5 includes an updated value for methane's 100-year GWP of 36,[35] which is 44 percent higher than the previous assessment due to methodological improvements in the calculation of methane's GWP. Previous IPCC assessments had failed to account for carbon cycle feedbacks when calculating the GWP for methane.

In addition, the timescale on which the GWP of methane is assessed cannot be based only on a "100-year" time span. Methane's GWP on a 20-year time span is 87, almost four times the value used in current 100-year calculations. As stated in the IPCC AR5, however, "there is no scientific argument for selecting 100 years [time horizons for GWPs] compared with other choices."[36] Using only a 100-year GWP means that consideration of the decadal impact of short-lived pollutants will be lost. This is especially important here, where the agency is assessing climate impacts within the next several decades. NHTSA must perform a comparative analysis for natural gas vehicles based on both values (36 for the GWP-100 and 87 for GWP-20).

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[34] National Research Council, *Reducing the Fuel Consumption and greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: First Report* at 2 (2014), *available at* http://sites.nationalacademies.org/DEPS/cs/groups/depssite/documents/webpage/deps_087582.pdf.

[35] G. Myhre et al., Anthropogenic and Natural Radiative Forcing, in Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change IPCC at 714 (Cambridge Univ. Press 2013), *available at* http://www.climatechange2013.org/images/report/WG1AR5_Chapter08_FINAL.pdf .

[36] *Id*. at 711.

Moreover, the leakage rate of methane during extraction and transport has been woefully underestimated. The Environmental Protection Agency currently assumes that natural gas systems have a combined upstream and downstream leakage rate of 1.8 percent. This was recently reduced from 2.5% for conventional gas and 3.9% for fracked natural gas in response to an industry study that was not subject to peer review.[37] Since that time, the Office of the Inspector General has issued a report indicating that EPA must improve its emission factors to better reflect direct measurements of methane leakage from natural gas production.[38]

There is compelling evidence that leakage rates from natural gas operations are far higher than EPA emission factors suggest. For instance, a recent study used atmospheric measurements to estimate fossil fuel methane leakage emissions at more than two times higher than EPA's estimates.[39] Observations from oil and gas operations in Colorado indicate that inventories underestimate methane emissions by at least a factor of two.[40] Leakage rates over a Utah gas field were recently estimated at 6.2 to 11.7%, well above the rates assumed by national inventories.[41] A recent meta-analysis of studies conducted over the last 20 years suggests that EPA's estimate of 1.8% is too low, with actual leakage rates between 3.6 and 7.1%.[42]

Any decision by NHTSA concerning natural gas vehicles must be based on a full life cycle analysis of this fossil fuel's GWP based on the correct metrics. In addition, NHTSA must consider the total environmental effects of any increased usage of such vehicles on the environment, including the effects of hydraulic fracturing and other unconventional extraction methods of natural gas on water, land use, air quality, and health. NHTSA should also consider whether natural gas vehicles would replace electric vehicles or stop their current growthover time; a full and accurate life cycle analysis will demonstrate the highly negative consequences of any such replacement.

We agree with NHTSA's decision to conduct full life-cycle and upstream analyses of the environmental impacts of all, and not just some, vehicle materials and technologies; in general, all greenhouse gas reduction measures should undergo careful and detailed life-cycle analyses to assure that the measures adopted will actually have the desired effect.[43]

We do not agree that NHTSA is not required to respond to comments that are similar to those made in response to NHTSA's prior rulemakings, and to which it has responded there. The

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[37] Shires, Terri and Miriam Lev-On, *Sources of Methane Emissions from Natural Gas Production Final Report*, American Petroleum Institute (Sept 21, 2012); Brandt, A.R. et al., Supplementary materials for *Methane Leaks from North American Natural Gas Systems*, 343 Science 733 (2014) (Brandt 2014).
[38] Office of Inspector General, *EPA Needs to Improve Air Emissions Data for the Oil and Natural Gas Production Sector* (Feb. 20, 2013), *available at* http://www.epa.gov/oig/reports/2013/20130220-13-P-0161.pdf.
[39] S. M. Miller et al., *Anthropogenic Emissions of Methane in the United States*, 100 PNAS 20018 (2013);
[40] G. Pétron et al., *Hydrocarbon Emissions Characterization in the Colorado Front Range: A Pilot Study*, 117 J. Geophys. Res. D04304 (2012); G. Pétron et al., *A New Look at Methane and Non-Methane Hydrocarbon Emissions from Oil and Natural Gas Operations in the Colorado Denver-Julesburg Basin*, 119 J. Geophys. Res. 6836 (2014).
[41] A. Karion et al., *Methane Emissions Estimate from Airborne Measurements over a Western United States Natural Gas Field*, 40 Geophys. Res. Lett. 4393 (2013).
[42] Brandt 2014.
[43] *See, e.g.*, Alissa Kendall and Lindsay Price, *Incorporating Time-Corrected Life Cycle Greenhouse Gas Emission in Vehicle Regulations*, 46 Environmental Science and Technology 5, 2557-2563 (2012).

science now demonstrates the need for extremely aggressive and rapid carbon reduction; our knowledge and understanding has changed dramatically in the intervening years; and the remaining carbon budget has now been firmly established by the IPCC. The situation we confront requires new thinking and new responses by the agency. For that reason, we believe NHTSA must take all current comments into consideration and respond to them.

The agency's statements that it may exclude alternatives because "heavy-duty vehicle owners and operators demand more immediate benefits" or, alternatively, will "accept benefits over the long-term despite higher initial costs"[44] are inappropriate as such concerns are outside of the range of factors the agency may consider. NHTSA is not in the business of designing, marketing or pricing vehicles for the consumer's pleasure or the manufacturer's profits. But even if such considerations were allowed, they are essentially irrelevant. The forthcoming rulemaking will affect all of the vehicles in the respective classes, and will, within those classifications, uniformly change their characteristics and affect their prices. In effect, there will be nothing for owners and operators to accept or reject.

We recommend the agency for its stated intent to spur manufacturing innovation and the adoption of new fuel-efficient technologies on trucks and semi-trailers, to assess advanced technologies not currently in production, and consider powertrain efficiency improvements, aerodynamics, weight reduction, improved tire rolling resistance, hybridization, automatic engine shutdown, and accessory improvements.[45] The agency must also incorporate future technologies now in the research phase but that can be developed within the rulemaking period. As before, we ask that the agency adopt a standard that requires the implementation of each, and not just some, of these technologies that are are or will be technically feasible and cost-effective, as that term must be understood in light of the climate crisis that confronts us.

VII. Conclusion

We appreciate the opportunity to submit these additional comment and thank you for your consideration.

Sincerely,

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[44] 79 Fed. Reg. 38846/1.
[45] 79 Fed. Reg. 38844/1.

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ATTACHMENT A

Comments by the Center re: Final Environmental Impact Statement, Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2021-2016 (February 2010); Docket No. NHTSA-2009-0059
(March 25, 2010)

CENTER *for* BIOLOGICAL DIVERSITY

VIA UPLOAD TO DOCKET NO. NHTSA-2009-0059 at REGULATIONS.GOV

March 25, 2010

National Highway Traffic Safety Administration
Docket Management Facility, M-30
U.S. Department of Transportation
West Building, Ground Floor, Rm. W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590
Attn: NHTSA-2009-0059

Re: Final Environmental Impact Statement, Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2012-2016 (February 2010); Docket No. NHTSA-2009-0059

The Center for Biological Diversity (the "Center") submits the following comments to the Final Environmental Impact Statement, Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2012-2016 (February 2010) ("FEIS"). On November 9, 2009, we also submitted comments to the Draft Environmental Impact Statement for the Proposed Rule (74 Fed. Reg. 48894), and on November 27, 2009, we submitted comments to the Proposed Rulemaking To Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Proposed Rule, 74 Fed. Reg. 49454 (September 28, 2009), EPA Docket ID No. EPA-HQ-OAR-2009-0472; NHTSA-2009-0059 (the "Proposed Rulemaking Comments"). We incorporate these earlier comment letters here by reference as if fully set forth herein. The Center is a non-profit environmental organization dedicated to the protection of imperiled species, their habitats, and the environment through science, policy, and environmental law. The Center has over 240,000 members and online activists throughout the United States. These comments are filed on behalf of our members and staff with a vital interest in reducing greenhouse gas and other air pollutants.

Although we support and applaud the agencies' first-ever effort to curb greenhouse gas ("GHG") emissions from the nation's passenger fleet and also improve the fleet's mileage standards, the proposed standards and environmental review fall short of what is required. As much as possible, the following comments focus on the flaws contained in the FEIS without repeating our previous comments concerning the proposed substantive rule or the DEIS.

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In 2007, the CO_2 emissions from U.S. passenger cars and light trucks accounted for nearly 20 percent of total U.S. CO_2 emissions. Because these emissions are the direct result of the amount of fuel the vehicles consume, setting fuel economy standards at the maximum feasible level is one of the most significant single actions the U.S. government can take today to reduce America's overall greenhouse gas emissions. Decades of global experience in automotive technology, setting mileage standards and improving fuel economy for passenger vehicles mean that the technological feasibility and the costs and benefits of reducing GHGs from this source are all extremely well understood. As such, the implementation of tailpipe GHG emissions reductions is among the most cost-effective and most efficient methods of limiting the destructive effects of global warming immediately. Thus, it is imperative that the FEIS fully and effectively disclose the consequences not just of the proposed action but also of alternatives that are truly technology forcing, and present and evaluate them in a manner that allows the decision-makers and the public to fully understand, analyze and compare their impacts in the context of the crucial overall role passenger vehicle fuel economy can play in combating climate change. While this FEIS contains a substantial amount of information, it nonetheless fails to accomplish that result for the following reasons:

- The FEIS presents no alternative under which the cumulative environmental impact of CO_2 emissions from the U.S. passenger car and light truck fleet is less than catastrophic, thereby artificially minimizing the true impact more stringent alternatives can have;
- The FEIS improperly treats emissions levels that will lead to unsustainable climate impacts as inevitable, and therefore fails to analyze available solutions to avoid this result;
- The FEIS fails to account for, avoid or minimize climate change tipping points;
- The FEIS presents no analysis of what must be done to cut emissions from U.S. passenger vehicles and light trucks to a sustainable level;
- The FEIS presents alternatives that are arbitrarily and capriciously constrained by inadequate and faulty cost-benefit analyses;
- The FEIS does not include alternatives that are truly "technology forcing."

I. The FEIS Presents No Alternative Under Which the Cumulative Environmental Impact of Emissions from the U.S. Passenger Car and Light Truck Fleet is Less Than Unsustainable, Thereby Artificially Minimizing the True Impact of More Stringent Alternatives Can Have

As fully explained in our Proposed Rulemaking Comments, a temperature increase of 1.4ºC over 1990 levels (or an increase of 2ºC over pre-industrial levels), corresponding to a CO_2 stabilization level of approximately 450 ppm, will create a fifty/fifty chance that severe and irreversible impacts from global warming will occur.[1] Yet, in the year 2100, even the most

[1] Joel B. Smith et al., *Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) "Reasons for Concern,"* PROC. OF THE NAT'L ACAD, SCL (Feb. 26, 2009) at 1, 5, *available at* http://www.pnas.org/content/early/2009/02/25/0812355106.abstract; IPPC WGII, 2007, *Climate Change 2007 – Impacts, Adaptation and Vulnerability Contribution of Working Group II to the Fourth Assessment Report of the IPCC*, at 11.

stringent alternative presented would, according to the FEIS, result in global CO_2 concentrations of 653.4 ppm and a temperature increase of 2.592ºC above today's level. FEIS, 4-57. Thus, accepting, *arguendo*, the agencies' assertion that catastrophic climate impacts at 450 ppm (most likely corresponding to a 2ºC temperature increase) or even 550 ppm (most likely corresponding to about 3ºC of warming) remain too uncertain to quantify, there is no such uncertainty at CO_2 levels of 653 ppm – these levels would cause environmental catastrophes under any scenario. NEPA and its implementing regulations direct federal agencies to "[u]se the NEPA process to identify and assess the reasonable alternatives to proposed actions that *will avoid or minimize adverse effects of these actions upon the quality of the human environment*," and "[u]se all practicable means . . . to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(e) and (f). Plainly, the proposed action and alternatives do not model GHG emission limitations that would contribute to the avoidance or minimization of environmental harm. An environmental impact assessment that seeks to justify agency action even though its "most stringent" implementation results in an outcome unsustainable for life as we know it is unreasonable *per se*.

The FEIS' analysis has the effect of proving that the agencies' regulatory approach is indeed insufficient. But the manner in which this conclusion is presented also creates the pernicious and incorrect illusion that the environmental outcome would not change regardless of what course of action the agencies choose. When the difference in the effects of all alternatives presented amounts to no more than mere single digits in parts per million of CO_2 concentrations or even fractions of a single digit in temperature and sea level rise, it appears that efforts to improve fuel efficiency beyond what the agencies have presented would be futile and irrelevant. This line of reasoning is not far from what the Supreme Court condemned in *Massachusetts v. EPA*:

> EPA nevertheless maintains that its decision not to regulate greenhouse gas emissions from new motor vehicles contributes so insignificantly to petitioners' injuries that the agency cannot be haled into federal court to answer for them. For the same reason, EPA does not believe that any realistic possibility exists that the relief petitioners seek would mitigate global climate change and remedy their injuries. That is especially so because predicted increases in greenhouse gas emissions from developing nations, particularly China and India, are likely to offset any marginal domestic decrease. [¶] But EPA overstates its case. Its argument rests on the erroneous assumption that a small incremental step, because it is incremental, can never be attacked in a federal judicial forum. Yet accepting that premise would doom most challenges to regulatory action. . . . . [¶¶] . . . Nor is it dispositive that developing countries such as China and India are poised to increase greenhouse gas emissions substantially over the next century: A reduction in domestic emissions would slow the pace of global emissions increases, no matter what happens elsewhere.

Massachusetts v. EPA, 549 U.S. 497, 523-26 (2007). As it did before the Supreme Court in 2007, NHTSA here argues that the effect of whatever fuel efficiency gains its regulations may achieve will be overwhelmed by other effects. FEIS at 2-38. Thus, while NHTSA no longer maintains that tailpipe GHG emissions should not be regulated at all, it justifies its decision not

to demand truly maximum feasible fuel efficiency by depicting the ultimate outcome of all regulatory efforts as *de minimis*. As shown below, the assumptions about the effects of global actions and the analysis of the effects of tailpipe GHG regulations on U.S. national emissions are faulty.

II. The FEIS Improperly Treats Emissions Levels that will Lead to Unsustainable Climate Impacts as Inevitable, and Therefore Fails to Analyze Available Solutions to Avoid this Result

The FEIS notes, correctly, that CO_2 stabilization levels are caused by global as well as U.S. emission levels, and therefore presents its alternatives in global terms. Its analysis and presentation, however, are highly misleading, since NHTSA essentially assumes that unsustainable climate change is inevitable, that nothing can be done, and that it is therefore not worth trying.

As the agency acknowledges, NEPA and CEQ implementing regulations require NHTSA to consider the foreseeable actions of others: "CEQ regulations implementing the procedural provisions of NEPA define cumulative impacts as 'the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions.' 40 CFR 1508.7." FEIS at 2-40. NHTSA identifies a number (though by no means all) of such reasonably foreseeable actions by U.S. regional, national, and international entities or groups, including GHG emission limitations planned or already implemented by California and other states and regions; U.S. GHG emission targets affirmed under the Copenhagen Accord in a pledge by President Obama to reduce U.S. GHG emissions to 17 percent below 2005 levels by 2020; the United Nation's Framework Convention on Climate Change and the Kyoto Protocol; and the G8 Declaration during the July 2009 G8 Summit in Italy

> "reiterating the broad scientific view that the increase in global average temperature above pre-industrial levels ought not to exceed 2ºC. Because this global challenge can only be met by a global response, we reiterate our willingness to share with all countries the goal of achieving at least a 50 percent reduction of global emissions by 2050 . . . [or] a goal of developed countries reducing emissions of greenhouse gases in aggregate by 80 percent or more by 2050 compared to 1990."

FEIS at 4-45. All of these efforts are designed to avert the worst effects of climate change, and many of them, including the quoted G8 Declaration, expressly commit its participants to holding temperate increases to no more than 2ºC past pre-industrial levels – or roughly a 450 ppm CO_2 stabilization level; some of them, such as state and regional efforts, already are enacted. While we agree that cumulatively, the currently enacted regulations and policies are inadequate to address the problem, this does not allow NHTSA to avoid looking at alternatives for its own action that will lead this sector of the U.S. economy to contribute its proportionate share of reductions to avoid unsustainable environmental change. As further discussed below, at a minimum, the FEIS should present and analyze an alternative in which the U.S. (including NHTSA) and the world both choose environmental sustainability over chaos, and GHG emissions from the passenger vehicle and light truck fleet in the U.S. are sufficiently reduced on

a proportional basis to achieve that goal.

III. The FEIS Fails to Consider Climate Tipping Points

Although the FEIS devotes considerable space to the discussion of tipping points and supplies valuable information, it provides no quantitative analysis of their effects even on a cumulative basis, and even though it concedes that tipping points cannot be avoided. The result is that the costs of exceeding these points, even though that is inevitable under all of the assumptions of the FEIS, is left entirely out of the equation.

The FEIS begins this discussion by defining climate tipping points as

> situations in which the climate system (the atmosphere, oceans, land, cryosphere and biosphere) reaches a point at which there is a disproportionally [sic] large or singular response in a climate-affected system as a result of only a moderate additional change in the inputs to that system (such as an increase in the CO2 concentration). Exceeding one or more tipping points, which "occur when the climate system is forced to cross some threshold, triggering a transition to a new state at a rate determined by the climate system itself and faster than the cause" . . . could result in abrupt changes in the climate . . . [that] could occur so quickly and unexpectedly that human systems would have difficulty adapting to them.

FEIS at 3-83-84. Despite the clear danger posed by and likelihood of tripping climate tipping points, NHTSA states that it has not quantified these risks under either its direct-indirect or its cumulative analysis, claiming that "the present state of the art does not allow for quantification of how emission reductions *from a specific policy or action* might affect the probability and timing of abrupt climate change." FEIS at 3-84, 4-49 (emphasis added). This justification cannot withstand scrutiny: under the cumulative impacts analysis, NHTSA need not quantify how increasing U.S. mileage standards alone would affect tipping points (indeed, no individual action by itself can halt GHG emissions sufficiently to avoid tipping points), when it can quantify the damages likely to arise from crossing them as a result of cumulative impacts. Instead, NHTSA assigns them a value of zero, a conclusion that is certain to be false.[2]

The FEIS' qualitative survey of tipping points provides ample information to begin quantification of the tipping point risk. The FEIS discusses continental, sub-continental, regional and local effects of crossing tipping points, including dramatic alteration of the Asian monsoon; overturning of the circulation system in the Atlantic Ocean; the collapse of the West Antarctic ice sheet; the loss of the Greenland ice sheet; drying in the southwestern United States leading to drought and increases in fire frequencies; and loss of the Sierra Nevada snow pack. The FEIS notes that such tipping points are characterized by rates of change sharply greater than what has prevailed over previous decades and change acceleration at a pace that exceeds the resources and ability of nations to respond to it. FEIS, 4-155. The FEIS further points out that tipping points

[2] Indeed, this zero value is also reflected in the crucial but incorrect assumption contained in the underlying rulemaking that the social cost of carbon increases by a linear and non-variable 3% per year over the next century. As the FEIS' discussion makes perfectly clear, there is no linearity in the effects of climate change.

can occur at levels "exceeding 450 ppm" and that, while "future abrupt changes cannot be predicted with confidence, . . . climate surprises are to be expected." FEIS at 4-156-157. The FEIS also notes that, based on "'growing evidence that even modest increases in [global mean temperature] could commit the climate system to the risk of very large impacts on multiple-century time scales,' the risks of large-scale discontinuities were expertly judged to begin being a source of substantial risk around 1 °C (around 2 °F). Smith *et al*. (2008) projected 2.5 °C (4.5 °F) . . . to be the 'possible trigger for commitment to large-scale global impacts over multiple-century time scales.'" FEIS at 4-157.

In other words, the best outcome the FEIS describes as resulting from its most stringent alternative and the "reasonably foreseeable" actions of other parties virtually commits the environment to massive, large-scale trigger points that cause changes to which we can no longer adapt. But, repeating the argument the Supreme Court rejected in *Massachusetts v. EPA* yet again, the FEIS concludes not only that quantification of the effects of these developments is impossible, but that nothing can be done:

> This action [setting mileage standards] alone, even as analyzed for the most stringent alternative, is very unlikely to produce sufficient CO2 emissions reductions to avert emission levels corresponding to abrupt and severe climate change. Under EPCA, as amended by EISA, NHTSA has the authority to set fuel economy standards for U.S. passenger cars and light trucks, which account for roughly 3.3 percent of global annual CO2 emissions. Even if NHTSA could set standards that reduced emissions from this sector to zero, tipping-point thresholds (whether they occur at 550 ppm or any other level of that general order of magnitude) would not likely be avoided without other significant global actions.

FEIS at 4-165. While superficially correct, this statement leads to the false conclusion that NHTSA is not required to provide any analysis of how the rulemaking could contribute to an environmental outcome in which cumulative action results in CO_2 stabilization at or below 450 ppm, particularly if the U.S. itself commences serious GHG reduction efforts. First and foremost among those actions, of course, is the very rulemaking the FEIS discusses.[3]

IV. The FEIS Presents No Analysis of What Must Be Done to Cut Emissions From U.S. Passenger Vehicles and Light Trucks to a Sustainable Level

In its previous comments, the Center has requested that NHTSA perform a back-casting analysis of alternative fuel efficiency standards that assumes that other actors also engage in conduct that avoids catastrophic climate change. Specifically, NHTSA should determine the total GHG emissions from now through 2016 (and beyond) from the light-duty vehicle fleet that would equal the sector's proportionate share of the maximum global allowable emissions necessary to reach atmospheric GHG concentrations low enough to avoid catastrophic climate change. That, in a nutshell, is what NEPA commands.

The tools to perform this analysis exist. In a study discussed in the FEIS, the authors

[3] Also absent is an analysis of the impact of forthcoming EPA regulations to limit GHG emissions from stationary sources under the Clean Air Act.

conclude that, assuming the transportation sector is one of seven "stabilization wedges," or activity bundles, from which carbon emission reductions can be achieved to hold global CO_2 concentrations to 500 ppm, the average fuel economy from the world's passenger cars and light truck fleet would have to be improved from an average of 30 mpg to 60 mpg by 2055. FEIS, 3-94 citing to Pacala and Socolow (2004). Using these numbers, the FEIS finds that its alternatives would produce the equivalent of 8 percent (Alternative 2) to 19 percent (Alternative 9) of the emissions reductions corresponding to this "stabilization wedge." While we appreciate NHTSA's inclusion of this calculation, it does not go far enough, since it does not translate this finding into any alternative that would in fact reach the desired result (at 500 ppm, at 450 ppm or, as the science suggests and the Center endorses, at 350 ppm).

The FEIS also fails to present alternatives that reach the far less ambitious goal set by President Obama's pledge at Copenhagen to reduce U.S. GHG emissions by 17 percent over 2005 levels by 2020 (equivalent to just 3 percent below 1990 levels, far less than the reductions needed for the U.S. to do its part to stabilize CO_2 concentrations at about 450 ppm). According to the FEIS, the proposed alternatives by 2020 would result in emission reductions from the light duty vehicle sector in the range of .06 percent above (Alternative 2) to 5.4 percent below (alternative 9) 2005 levels. FEIS Summary at 14. This information is useful as it clearly demonstrates the insufficiency of NHTSA's proposal, but it falls short of presenting an alternative that would do its part to achieve the Presidential goal.

V. The FEIS Presents Alternatives That are Arbitrarily and Capriciously Constrained by Inadequate and Faulty Cost-Benefit Analyses

As fully set forth in the Proposed Rulemaking Comments, the rulemaking's assumptions concerning costs and benefits are skewed against reaching the truly maximum feasible fuel efficiency standards that are mandated by law. The following discussion focuses on some additional cost-benefit analysis flaws.

The inadequacy of the social cost of carbon assumed by the agencies, both as to present value and as to how that value increases over time, is demonstrated by the fact that the FEIS assumes climate tipping points will be exceeded to a high degree of certainty, with environmental damage that could be measured in the range of up to 14 percent of global GDP.[4] Avoiding those damages must be counted among the benefits of the proposed action, but the rulemaking specifically excludes these costs even though the FEIS characterizes them as the "reasonably foreseeable" cumulative outcome.

The FEIS and underlying rulemaking also contain key assumptions about the growth in the number of vehicles in use in the U.S. and the number of vehicle miles traveled. The FEIS points out that the resulting growth in total passenger car and light truck travel "overwhelms" the fuel economy improvements of each alternative, resulting in large projected increases in total fuel consumption over time. *See* FEIS Summary at 12, 2-33. However, the FEIS discounts or fails to consider the effect of numerous local and regional programs designed to reduce vehicle

[4] Sir Nicholas Stern, *Stern Review on the Economics of Climate Change*, CAMBRIDGE UNIVERSITY PRESS (2006), Executive Summary at ix-x, available at http://www.sternreview.org.uk.

miles traveled ("VMT"), as outlined in our Proposed Rulemaking Comments.[5] Moreover, once the true social cost of carbon is factored into the equation so that technology innovation is driven despite higher vehicle costs, incentives for reducing VMT will be created. Contrary to NHTSA's assertion, the manner in which it regulates fuel efficiency standards thus can have a considerable role in shaping Americans' driving habits.

The FEIS' analysis of the impacts of the rulemaking is also skewed by the failure to assume continuing progress in fuel efficiency. After the year 2016 (or 2020, depending on the manner in which EISA's mandates are accounted for in the modeling), the analysis assumes only the small fuel efficiency increases projected through 2030 based on the Annual Energy Review's forecast (average annual percentage gains of 0.51 percent in passenger car mpg and .086 percent in light truck mpg) through 2030. Thereafter, fuel efficiency is assumed to remain constant for another 70 years. FEIS at 3-85. In other words, the FEIS assumes the absence of continuing regulations that force fuel efficiency improvements over the coming years and decades, either under the CAFE standards or any other laws. That leads to a significant understatement of the effect of further reductions of GHG emissions from the vehicle fleet, and ignores the well established fact that greater fuel economy improvements today will enable greater fuel economy improvements in the future.

VI. The FEIS Does Not Present Alternatives That Are Truly Technology Forcing

In its Proposed Rulemaking Comments, the Center showed that none of NHTSA's modeled alternatives are truly technology forcing. Among other things, the Center suggested that NHTSA should analyze the effect of applying existing technology to the vehicle fleet unconstrained by adherence to the "refresh" and "redesign" cycles generally followed by automotive manufacturers (except when it finds reasons not do to so, such as in response to recent economic pressures), an approach that would lead to more rapid technology integration. The FEIS' response characterizes this suggestion as follows: "In CBD's opinion, these development cycles should have no bearing on the considerations of technology implementation within the cost-benefit analysis." This response misapprehends the comment, since lead time already built into the CAFE rulemaking would continue to respond to the need for development cycles. Moreover, the comment focuses on the absence of any attempt to analyze the result of discarding adherence to this manufacturer's practice, not on whether changing development cycles and the costs associated therewith should have no bearing. Certainly, quicker technology adaptation than is possible under the constraints of "refresh" and "redesign" cycles may increase manufacturers' costs, although, in light of the facts that the benefits of higher mileage standards far outweigh their costs, any such increases are unlikely to affect the outcome. The point is that NHTSA apparently has not undertaken the necessary analysis, instead constraining its assessment of what should be a technology forcing standard to depend on manufacturers' plans to conduct business as usual.

In addition, NHTSA's modeling assumes that some manufacturers will make technology improvements only to the point that doing so would be less expensive than paying civil penalties. FEIS at 2-17. Thus, the model does not account for the possibility that manufacturers would

[5] NHTSA also does not consider what impact increases in vehicle costs (which might result from high fuel efficiency requirements) might have on VMTs and therefore on increased CO2 emission reductions. In addition,

adopt existing technologies (much less develop new technologies) even if the costs of doing so exceed civil penalties. There is no evidence, however, that business and other considerations would not cause manufacturers to act differently. Moreover, there is no analysis of the effect higher civil penalties could have in achieving truly technology forcing outcomes. Because the fact remains that vehicle fleets in Europe and Japan today do far better than the rulemaking would require of the U.S. fleet by 2016, there is no doubt that the rule fails to force the full implementation even of existing technology.

VII. **Conclusion**

We appreciate the opportunity to submit these additional comment and thank you for your consideration.

Sincerely,

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ATTACHMENT B

Comments by the Center re: Notice of Intent To Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program, 75 Fed. Reg. 33565 (June 14, 2010); Docket No. NHTSA-2010-0079
(July 14, 2010)

CENTER *for* BIOLOGICAL DIVERSITY

VIA UPLOAD TO DOCKET NO. NHTSA-2010-0079 at REGULATIONS.GOV

July 14, 2010

National Highway Traffic Safety Administration
Docket Management Facility, M-30
U.S. Department of Transportation
West Building, Ground Floor, Rm. W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590
Attn: NHTSA-2010-0079

Re: Notice of Intent To Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program, 75 Fed. Reg. 33565 (June 14, 2010); Docket No. NHTSA-2010-0079

The Center for Biological Diversity (the "Center") submits the following comments in response to the Notice of Intent To Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program, 75 Fed. Reg. 33565 (June 14, 2010, Docket No. NHTS-2020-0079 (the "Notice") issued by the National Highway Traffic Safety Administration ("NHTSA"). The Center is a non-profit environmental organization dedicated to the protection of imperiled species, their habitats, and the environment through science, policy, and environmental law. The Center has over 255,000 members and online activists throughout the United States. These comments are filed on behalf of our members and staff with a vital interest in reducing greenhouse gas and other air pollutants.

We fully support NHTSA's effort to curb greenhouse gas ("GHG") emissions from new medium- and heavy-duty on-highway vehicles and work trucks ("MD/HD Vehicles") and appreciate the opportunity to submit comments on the forthcoming draft Environmental Impact Statement that will accompany the agency's rulemaking. We submit these comments in hopes that they may inform NHTSA's analysis and help avoid flaws contained in the final environmental impact statement (the "LD Vehicle FEIS") accompanying the agency's light-duty vehicle greenhouse gas emission standards and corporate average fuel economy standards rule published on May 7, 2010, 75 Fed. Reg. 25324 (the "LD Vehicle Rule").

In 2007, the CO_2 emissions from U.S. MD/HD Vehicles constituted 24.8 percent of all

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greenhouse gas emissions from motor vehicles and engines, the fastest growing source of U.S. greenhouse gas emissions since 1990.[1] Because these emissions are closely related to the amount of fuel the vehicles consume, setting fuel efficiency standards at the maximum feasible level is among the most significant single actions the U.S. government can take to reduce America's overall greenhouse gas emissions. Thus, it is imperative that the forthcoming EIS fully and effectively disclose the consequences of the proposed actions and present and evaluate them in a manner that allows the decision-makers and the public to understand, analyze and compare their impacts in the context of the role MD/HD Vehicle fuel efficiency can play in combating climate change. Specifically, we note the following:

- As requested by NHTSA, we submit a selection of recent scientific literature that updates the scientific work the agency refers to in the Notice. These sources demonstrate that the maximum feasible fuel economy improvements must be reached as quickly as possible.
- NHTSA should analyze the alternatives it discusses in a manner that does not artificially minimize the true impact the more stringent alternatives can have by misleadingly implying that because NHTSA does not control all sources of greenhouse gas emissions, the impact of its rulemaking will be negligible.
- NHTSA should analyze and discuss an alternative that accounts for and avoids, or minimizes the likelihood, of reaching climate change tipping points.
- NHTSA should analyze and discuss alternatives that contribute to the reduction of greenhouse gas emissions from MD/HD Vehicles to levels that allow the U.S. to reduce its overall emissions to sustainable levels. In particular, the MD/HD Vehicle environmental impact statement should include an analysis of the extent to which each of the proposed alternatives would contribute proportionally to a reduction of U.S. greenhouse gas emissions to (a) 17% below 2005 levels by 2020 (a goal formulated by President Obama); (b) 25-40% below 1990 levels by 2020 (a goal necessary to hold global warming below 2 degrees Celsius); and (c) 45% or more below 1990 levels by 2020 (a goal required to begin reducing CO_2 to 350 ppm).
- NHTSA should present alternatives that are "technology forcing."
- NHTSA should conduct a cost-benefit analysis that properly accounts for all of the damages caused by climate change and that recognizes that mitigation costs will sharply increase over time.
- NHTSA should adopt the alternative that reduces greenhouse gas emissions from MD/HD vehicles to the maximum extent possible, as quickly as possible.

While the Notice does not solicit comments concerning the proposed substantive rule, we also note that NHTSA has proposed to delay commencement of the MD/HD vehicle standards until Model Year ("MY") 2016. In light of the urgency of taking action to avoid the worst results of

[1] FACT SHEET, EPA AND NHTSA TO PROPOSE GREENHOUSE GAS AND FUEL EFFICIENCY STANDARDS FOR HEAVY DUTY TRUCKS, EPA-420-F-10-038 (May 2010), *available at* http://epa.gov/otaq/climate/regulations/420f10038.htm; U.S. EPA, 2009 TECHNICAL SUPPORT DOCUMENT FOR ENDANGERMENT AND CAUSE OR CONTRIBUTE FINDINGS ON GREENHOUSE GASES UNDER SECTION 202(A) OF THE CLEAN AIR ACT at 181, *available at* http://epa.gov/climatechange/endangerment/downloads/Endangerment%20TSD.pdf.

climate change, the standards should go into effect as soon as the law allows, *i.e.*, *four* years after finalization of the proposed rule in 2011 (thus, beginning with MY 2015).[2] Further, NHTSA's laudable plan to develop an optional voluntary compliance standard before mandatory standards take effect should begin with Model MY 2011-2014, not MY 2014-2015.

I. Recent Scientific Evidence Demonstrates that Risks from Climate Change Are Substantially Greater Than Assessed in the 2007 IPPC Fourth Assessment Report

NHTSA notes that in assessing the impacts of MD/HV Vehicle greenhouse gas emissions on climate change and analyzing various alternatives to curb such emissions, it intends to rely primarily on the IPCC 2007 Fourth Assessment Report ("ICCP AR4") and subsequent updates, reports of the U.S. Climate Change Science Program and the current U.S. Global Change Research Program. Notice, 75 Fed. Reg. 33568. In response to NHTSA's request for additional scientific studies that address or may inform the impacts of emission reductions on climate change and the time periods over which such impacts may occur, we submit the attached literature. Compendia summarizing peer-reviewed research published since the IPCC AR4 include the *Climate Change Science Compendium* compiled by the United Nations Environment Programme (McMullen and Jabbour 2009), *Climate Change: Global Risks, Challenges and Decisions Synthesis Report* compiled by the International Alliance of Research Universities (Richardson et al. 2009), *The Copenhagen Diagnosis* (Allison et al. 2009), and Fussel (2009).[3] We concur with the National Academy of Science's assessment that the upcoming MD/HD vehicle rulemaking "is an important juncture for the nation. The choices that will be made over the course of the next few years will establish the regulatory design for [MD/HD vehicle] fuel consumption standards for the next several decades at least."[4] For that reason, the agency must base its rulemaking and EIS analysis on the most updated and relevant scientific evidence available.

a. Risks From Climate Change are Substantially Greater than Assessed in the 2007 IPCC Fourth Assessment Report

Recent observations of climate change, improved analyses, and modeling studies indicate that several key risks from anthropogenic climate change are substantially greater than assessed in the IPCC AR4, including risks that would be categorized as "dangerous anthropogenic interference with the climate system" under the language of the United Nations Framework Convention on Climate Change (Fussel 2009, Smith et al. 2009). Climate is changing more quickly than projected by earlier IPCC reports; climate impacts are occurring at lower surface temperatures than previously estimated; temperature change and sea level rise during this century

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[2] *See* 49 U.S.C. § 32902(k)(3) ("[t]he [MD/HD vehicle] fuel economy standard . . . shall provide not less than . . . four model years of regulatory lead-time").

[3] Full citations to the literature referenced herein are provided in Attachment A, and the articles themselves are provided in Attachment B.

[4] NATIONAL ACADEMY OF SCIENCES, TRANSPORTATION RESEARCH BOARD, NATIONAL RESEARCH COUNCIL, COMMITTEE TO ASSESS FUEL ECONOMY TECHNOLOGIES FOR MEDIUM- AND HEAVY-DUTY VEHICLES, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehciles* (March 2010, *pre-publication copy available at* http://www.nap.edu/catalog.php?record_id=12845 (the "NAS Study")

will be greater than previously projected; and the climate is approaching tipping points beyond which the climate system will switch to a different state more quickly than previously projected (Fussel 2009, Lenton et al. 2008, McMullen and Jabbour 2009, Richardson et al. 2009).

Recent scientific studies have also increased the understanding of several processes that delay the full impacts of greenhouse gases and make climate change impacts extremely long-lasting: (1) the climate commitment (i.e. future warming and sea-level rise resulting from greenhouse gas concentrations that are *already* in the atmosphere); (2) the irreversibility of climate change and ocean acidification from CO_2 emissions; (3) the triggering of tipping points; and (4) the enhancement of positive feedback cycles that amplify climate change. These scientific studies indicate that current warming and the climate commitment *presently* constitute 'dangerous anthropogenic interference' with the climate system, and that the safe upper limit for atmospheric CO_2 needed to avoid 'dangerous climate change' is at most 350 ppm. They demonstrate that a reasonable probability of avoiding dangerous climate change cannot be achieved unless immediate and significant reductions of CO_2 and other greenhouse gases occur.

i. The Climate Commitment

Thermal inertia in the climate system causes a time lag between the emission of greenhouse gases and the full physical climate response to those emissions. Thus, the climatic changes experienced so far *are only part* of the full response expected from the greenhouse gases already in the atmosphere (Hansen et al. 2008). The delayed effects from existing emissions are known as the "climate commitment." The magnitude of committed warming from past greenhouse gas emissions is now estimated to be higher than reported in the IPCC AR4 (Fussel 2009). Based on the greenhouse gases already emitted, the planet is most likely committed to additional warming over pre-industrial levels estimated at 1.6°C (most of which is expected to be experienced in this century due to the unmasking of the aerosol cooling effect by air pollution abatement laws) (Ramanathan and Feng 2008) and up to 2°C in the long-term (Hansen et al. 2008), rather than the 0.6°C increase estimated in the IPCC AR4 (Meehl et al. 2007). In addition, sea-level rise will continue for centuries due to continuing thermal expansion of the oceans and melting of the Greenland and West Antarctic ice sheets (Richardson et al. 2009). Any greenhouse gases added to the atmosphere exacerbates the climate commitment.

ii. Irreversible Impacts of CO_2 Emissions

Climate changes caused by increases in CO_2 concentrations, including temperature increases and sea-level rise, are largely irreversible for 1,000 years *after emissions cease* (Archer and Brovkin 2009, Solomon et al. 2009), while increases in ocean acidification will persist for hundreds of thousands to millions of years (Richardson et al. 2009). An important contributing factor is the long atmospheric lifetime of CO_2 compared to other greenhouse gases. A significant fraction of anthropogenic CO_2, ranging from 20–60%, remains airborne for a thousand years or longer after emissions cease (Archer and Brovkin 2008, Solomon et al. 2009). Approximately 25% of emitted CO_2 will have an atmospheric lifetime of more than 5000 years (Montenegro et al. 2007).

Some of the anthropogenic CO_2 is removed from the atmosphere by deep ocean mixing; however, global average temperatures are not projected to drop significantly for at least 1,000 years after the cessation of emissions because the removal of CO_2 by deep-ocean mixing is largely compensated by heat emission from the ocean (Matthews and Caldeira 2008, Solomon et al. 2009). Studies suggest that two-thirds of the maximum temperature anomaly from CO_2 emissions will persist for longer than 10,000 years (Eby et al. 2009). Anthropogenic CO_2 also causes irrevocable sea-level rise. Long-lasting warming from persistent CO_2 causes the oceans to continue to expand and the continued melting of the glaciers and ice sheets, which in turn contribute to millennia of sea-level rise (Solomon et al. 2009). In addition, the long tail of fossil fuel CO_2 in the atmosphere may trigger slow processes and feedbacks including methane hydrate release from the ocean and methane release from melting permafrost (Archer and Brovkin 2008). As summarized by Matthew and Caldeira (2008), "fossil fuel CO_2 emissions may produce climate change that is effectively irreversible on human timescales."

As stated in one study:

> It is sometimes imagined that slow processes such as climate changes pose small risks, on the basis of the assumption that a choice can always be made to quickly reduce emissions and thereby reverse any harm within a few years or decades. We have shown that this assumption is incorrect for carbon dioxide emissions, because of the longevity of the atmospheric CO_2 perturbation and ocean warming. Irreversible climate changes due to carbon dioxide emissions have already taken place, and future carbon dioxide emissions would imply further irreversible effects on the planet, with attendant long legacies for choices made by contemporary society.

Solomon et al. (2009) at 708-1709. And, according to another study:

> The notion is pervasive in the climate science community and in the public at large that the climate impacts of fossil fuel CO_2 release will only persist for a few centuries. This conclusion has no basis in theory or models of the atmosphere/ocean carbon cycle, which we review here. The largest fraction of the CO_2 recovery will take place on time scales of centuries, as CO_2 invades the ocean, but a significant fraction of the fossil fuel CO_2, ranging in published models in the literature from 20–60%, remains airborne for a thousand years or longer. Ultimate recovery takes place on time scales of hundreds of thousands of years, a geologic longevity typically associated in public perceptions with nuclear waste. The glacial/interglacial climate cycles demonstrate that ice sheets and sea level respond dramatically to millennial-timescale changes in climate forcing. There are also potential positive feedbacks in the carbon cycle, including methane hydrates in the ocean, and peat frozen in permafrost, that are most sensitive to the long tail of the fossil fuel CO_2 in the atmosphere.

Archer and Brovkin (2008) at 283.

iii. Tipping Points for Abrupt Climate Change

Growing greenhouse gas emissions have the potential to trigger "tipping points," critical points where the climate system switches rapidly to a qualitatively different state (Lenton et al. 2008, Schellnhuber 2009). Paleoclimatic evidence indicates that abrupt nonlinear changes in the climate system have occurred in the past, in which small increases in average surface temperature produced qualitatively different states of the climate system that were irreversible on a timescale of millennia (Molina et al. 2009). Lenton et al. (2008) reviewed "tipping elements" in the Earth's climate system that could be altered by anthropogenic climate forcing and found several elements that are *already close to reaching a tipping point*. As reported by Lenton et al. (2008), warming of 0.5-2°C above 1990 levels (which is well within the low end of our current warming commitment) could trigger the total loss of the Arctic summer sea ice, while warming of 1-2°C above 1990 levels could lead to the complete melting of the Greenland ice sheet, resulting in an eventual seven meters of sea level rise. Other climate studies have warned that the Arctic climate system may have already reached a tipping point leading to a rapid transition to a seasonally ice-free Arctic (Lindsay and Zhang 2005).

iv. Feedbacks

Climate forcings can trigger reinforcing positive feedbacks that can further amplify warming. For example, the Arctic ice-albedo feedback loop is already occurring, where the loss of sea ice due to warming reduces the surface albedo and makes the Arctic more vulnerable to future warming. Scientific studies indicate that increased warming will trigger other feedbacks, including the mobilization of carbon in tropical peatlands which are vulnerable to land clearing and drainage, and the release of methane from Arctic permafrost due to warming (Richardson et al. 2009).

v. Dangerous Climate Change

A key objective of the United Nations Framework Convention on Climate Change (UNFCCC) set forth in 1992 is to stabilize greenhouse gas concentrations in the atmosphere "at a level that would prevent dangerous anthropogenic interference with the climate system." In regard to species and ecosystems, UNFCCC Articles 2 and 3 specifically stated that "[s]uch a [concentration stabilization] level [to avoid DAI] should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change" and emphasized avoiding ''threats of serious or irreversible damage" (Solomon et al. 2009) where irreversible is measured on time frames relevant to contemporary society (Richardson et al. 2009). Avoiding dangerous anthropogenic interference (DAI) has been the key international policy goal for protecting the global climate since this objective was set forth in 1992.

The UNFCCC did not define the emissions reductions needed to avoid DAI. The European Union in 1996 set an objective to limit global warming to less than 2°C above pre-industrial temperature (1.4°C above 1990 temperature, 1.3°C above 2000 temperature) to avoid DAI, which it reiterated most recently in 2009 (European Council 1996, 2005, 2009). The 2009 Copenhagen Accord, to which the United States is a signatory, recognizes "the scientific view

that the increase in global temperature should be below 2 degrees Celsius."[5] This 2°C objective has been widely accepted as "the 2°C guardrail." However, the best available scientific information indicates that a 2°C mean global temperature rise from pre-industrial levels is far in excess of what can reasonably be considered "dangerous" and that much smaller increases in global mean temperature will result in substantial environmental and socio-economic consequences (Hansen et al. 2008, Richardson et al. 2009, Smith et al. 2009).

Numerous scientific studies indicate that current warming and the warming commitment "in the pipeline" already constitute dangerous anthropogenic interference (Hansen et al. 2008, Lenton et al. 2008, Jones et al. 2009, Pimm 2009, Rockstrom et al. 2009, Smith et al. 2009). For example, the updated IPCC Reasons for Concern (RFCs) reflect that current warming is already at a point where significant risks from extreme weather events and risks to species and ecosystems are occurring, and that these risks will become "severe" at a ~1 to 1.5°C rise above preindustrial levels (Smith et al. 2009). The Synthesis Report of the Copenhagen Climate Congress also concluded that the 2°C guardrail (2°C temperature rise above preindustrial temperatures) carries "significant risks of deleterious impacts…for the environment":

> In summary, although a 2°C rise in temperature above pre-industrial remains the most commonly quoted guardrail for avoiding dangerous climate change, it nevertheless carries significant risks of deleterious impacts for society and the environment. (Richardson et al. 2009: 16).

The chart below demonstrates the drastic increases in risk levels of reaching dangerous climate change impacts as and CO_2 levels have continued to rise, and our scientific understanding of the consequences has grown:

[Intentionally left blank]

[5] The Copenhagen Accord is available at http://www.denmark.dk/en/menu/Climate-Energy/COP15-Copenhagen-2009/cop15.htm.

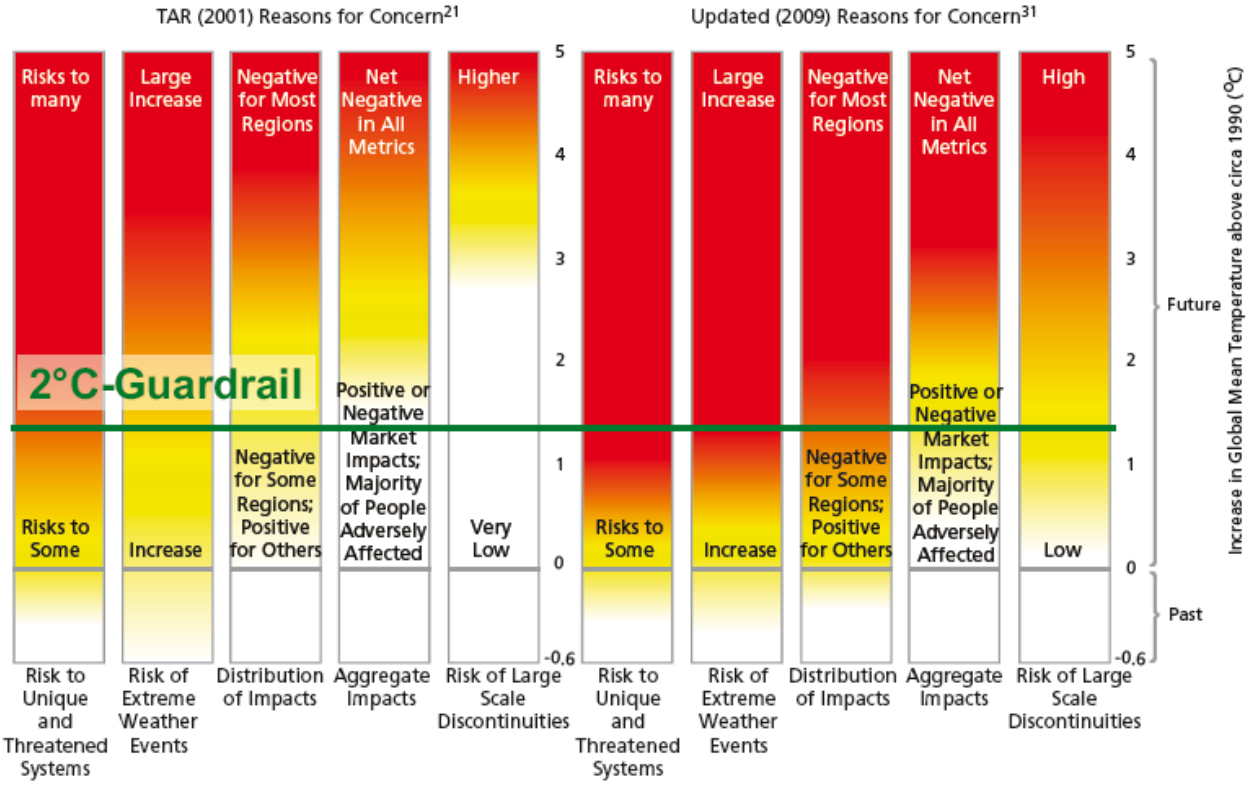

Figure 5. Diagram relating the potential impacts of climate change to the rise in global average temperature. Zero on the temperature scale corresponds approximately to 1990 average temperature, and the bottom of the temperature scale to pre-industrial average temperature. The level of risk or severity of potential impacts increases with the intensity of red color. The 2°C guardrail is shown for reference. Source: Richardson et al. 2009: Figure 8.

vi. Greenhouse Gas Levels Needed to Avoid Dangerous Climate Change

Hansen et al. (2008) and Rockstrom et al. (2009) presented evidence that the safe upper limit for atmospheric CO_2 needed to avoid 'dangerous climate change' is at most 350 ppm. Hansen et al. (2008) found that our current CO_2 level has committed us to a dangerous warming commitment of ~2°C temperature rise still to come and is already resulting in dangerous changes: the rapid loss of Arctic sea-ice cover, a 4° poleward latitudinal shift in subtropical regions leading to increased aridity in many regions of the earth; the near-global retreat of alpine glaciers affecting water supply during the summer; accelerating mass loss from the Greenland and west Antarctic ice sheets; and increasing stress to coral reefs from rising temperatures and ocean acidification. Hansen et al. (2008) concluded that the overall target of at most 350 ppm CO_2 must be pursued on a timescale of decades since paleoclimatic evidence and ongoing changes suggest that it would be dangerous to allow emissions to overshoot this target for an extended period of time:

> If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm, but likely less than that. (Hansen et al. 2008: 217)

With atmospheric carbon dioxide at ~390 ppm and worldwide emissions continuing to increase by more than 2 ppm each year, rapid and substantial reductions in CO_2 are clearly needed immediately to safeguard human health and welfare, protect the environment, and avoid the worst impacts of climate change.

b. Importance of Early Mitigation: Any Delay in Mitigation Significantly Increases Climate Risks and Long-Term Costs

Scientific studies have shown that delaying mitigation significantly increases climate risks and/or long-term costs. Vaughan et al. (2009), den Elzen et al. (2010), Mignone et al. (2008), Meinshausen et al. (2009), Allen et al. (2009), Lowe et al. (2009). In other words, mitigation measures available now that are *not* implemented because of cost concerns will become much more costly at a later time and, if tipping points are reached, will be unable to alter irreversible damage.

The following quotes from the scientific literature demonstrate these facts:

> We present a simple conceptual model of anthropogenic CO_2 emissions to highlight the trade off between delay in commencing mitigation, and the strength of mitigation then required to meet specific atmospheric CO_2 stabilization targets. We calculate the effects of alternative emission profiles on atmospheric CO_2 and global temperature change over a millennial timescale using a simple coupled carbon cycle-climate model. For example, if it takes 50 years to transform the energy sector and the maximum rate at which emissions can be reduced is −2.5% year−1, delaying action until 2020 would lead to stabilization at 540 ppm. A further 20 year delay would result in a stabilization level of 730 ppm, and a delay until 2060 would mean stabilizing at over 1,000 ppm. If stabilization targets are met through delayed action, combined with strong rates of mitigation, the emissions profiles result in transient peaks of atmospheric CO_2 (and potentially temperature) that exceed the stabilization targets. Stabilization at 450 ppm requires maximum mitigation rates of −3% to −5% year−1, and when delay exceeds 2020, transient peaks in excess of 550 ppm occur. *Consequently tipping points for certain Earth system components may be transgressed. Avoiding dangerous climate change is more easily achievable if global mitigation action commences as soon as possible. Starting mitigation earlier is also more effective than acting more aggressively once mitigation has begun*.

Vaughan et al. (2009) at 29 (emphasis added).

> Delaying global mitigation action is much more significant than the overall time it takes for the global socio-economic system to make the transition to decarbonisation. *It is more prudent to begin mitigation action soon, than to decarbonise more rapidly at a later*

> *date. Furthermore, the greater the delay in global mitigation action the more likely it becomes that an overshoot of a specified stabilization target will occur, and the longer the duration of the overshoot becomes.* These overshoots have particular relevance to concerns regarding 'tipping points' in the Earth system and the potential negative impacts of exceeding certain thresholds. A critical feature of the landscapes generated here is the assumed initial future growth rate in emissions. Our choice of growth rate, based on long term trends, is quite conservative and significantly lower than the actual trend of the last 5 years. Should the most recent trend persist, a much bleaker picture is painted, and early and rapid global mitigation action becomes even more important.

Id. at 42 (emphasis added).

> Substantially postponing the emission reductions, compared to the ranges indicated in IPCC's recent assessment for 2020 as required for meeting the longterm 2 °C target, increases the risk of exceeding this target. *The costs of a delay strategy are lower in the short term, but lead to higher costs in the longer term. The analysis shows if the emission reductions are postponed to 2030 it is* not *likely that higher emissions from the earlier years can be fully compensated in future decades in a so-called 'delayed action scenario'.* A full compensation would require emission reduction rates in the coming decades that are much higher than those found in the scenario literature. Without compensation, the risk of exceeding the global temperature rise target of 2◦C will increase. This confirms that it is not only the reduction commitments for 2050 that determine the risk of exceeding the 2 °C target, but also the path between now and 2050. To meet this 2 °C target, more ambitious 2020 reduction targets are needed for the developed and developing countries than those that have been pledged so far.

Den Elzen et al. (2010) at 313 (emphasis added).

> For example, Meinshausen *et al.* argue that peaking global emissions before 2020, cutting them at least 50 per cent below 1990 levels by 2050 and continuing reductions thereafter gives us a reasonable chance of staying within a budget consistent with limiting warming to 2 °C, but securing agreement on this will undoubtedly be hard. This is where acknowledging the principle of a cumulative budget could be helpful: the higher emissions are allowed to be in 2020, the lower they will need to be in 2050 to stay within the same overall budget. *From this perspective, the argument for early emission cuts becomes primarily an economic and technical one: late and rapid reductions are risky, expensive and disruptive, and hence potentially politically infeasible. And the sooner we start, the more flexibility we have to adjust policies as new scientific information becomes available. Cutting emissions later also raises the issue of inter-generational equity, as the costs of very steep emission reductions in the future (assuming these are feasible) could well exceed the economic benefits of postponing mitigation*.

Allen et al (2009) at 57 (emphasis added, footnote omitted).

> Climate models provide compelling evidence that if greenhouse gas emissions continue at present rates, then key global temperature thresholds (such as the European Union limit of two degrees of warming since pre-industrial times) are very likely to be crossed in the

> next few decades. However, there is relatively little attention paid to whether, should a dangerous temperature level be exceeded, it is feasible for the global temperature to then return to safer levels in a usefully short time. We focus on the timescales needed to reduce atmospheric greenhouse gases and associated temperatures back below potentially dangerous thresholds, using a state-of-the-art general circulation model. This analysis is extended with a simple climate model to provide uncertainty bounds. We find that even for very large reductions in emissions, temperature reduction is likely to occur at a low rate. *Policy-makers need to consider such very long recovery timescales implicit in the Earth system when formulating future emission pathways that have the potential to 'overshoot' particular atmospheric concentrations of greenhouse gases and, more importantly, related temperature levels that might be considered dangerous.*

Lowe et al. (2009) at 1 (emphasis added).

In sum, the recent scientific studies highlight the following crucial points that must inform NHTSA's analysis and final choice among the alternatives available to reduce greenhouse gases from MD/HD Vehicles:

- The deleterious effects of climate change, including temperature and sea level rise, have occurred faster than the IPCC AR4 predicted.
- The likelihood that climate change will cause further environmental, economic and societal damage on a global scale, and the severity of that damage, are both substantially greater than described in the IPCC AR4.
- It is now well understood that the climate commitment exposes us to levels of additional warming that is not yet felt but already unavoidable, irreversible and dangerous.
- Without mitigation, triggering points that cause irreversible climate change will occur earlier than predicted and may occur within decades rather than centuries; some may have already occurred.
- Most of the CO_2 now in the atmosphere will remain there for time frames measured in millennia, and its effects will be experienced over those time frames; all CO_2 additions exacerbate the situation.
- The costs of mitigation measures undertaken today are low when compared to their costs at any later date; if trigger points are exceeded, no amount of expense can reverse the damage.
- Risks of catastrophic climate change cannot be avoided unless concentrations of CO_2 are lowered to 350 ppm or less.

II. The EIS Should Analyze and Present Alternatives in a Manner that Does Not Misleadingly Imply that, Because NHTSA Does Not Control All Sources of Greenhouse Gas Emissions, the Impact of Its Rulemaking Will Be Negligible

Because NHTSA has indicated that it will "focus on the impacts [of climate change] in much the same manner as it did in the prior EIS," 75 Fed. Reg. 33568, we here address what we believe were critical inadequacies of that prior analysis, and request that NHTSA remedy them.

In particular, in our comment letter to NHTSA concerning the LD Vehicle FEIS (the "Comment Letter"),[6] we discussed the manner in which NHTSA presented the effects of the proposed greenhouse gas emission reductions on what it claimed was their foreseeable cumulative result in terms of CO_2 levels, temperature and sea level rise and other consequences. We noted that a temperature increase of 1.4ºC over 1990 levels (or an increase of 2ºC over pre-industrial levels), corresponding to a CO_2 stabilization level of approximately 450 ppm, will create a fifty/fifty chance that severe and irreversible impacts from global warming will occur.[7] Yet, the LD Vehicle FEIS showed that in the year 2100, even the most stringent alternative presented would result in global CO_2 concentrations of 653.4 ppm and a temperature increase of 2.592ºC above today's level, and provided no alternative analysis. LD Vehicle FEIS, 4-57. Although NHTSA and EPA asserted that catastrophic climate impacts at 450 ppm (most likely corresponding to a 2ºC temperature increase) or even 550 ppm (most likely corresponding to about 3ºC of warming) remain too uncertain to quantify, there is no such uncertainty at CO_2 levels of 653 ppm – these levels would cause environmental catastrophes under any scenario. NEPA and its implementing regulations direct federal agencies to "[u]se the NEPA process to identify and assess the reasonable alternatives to proposed actions that *will avoid or minimize adverse effects of these actions upon the quality of the human environment*,", and "[u]se all practicable means . . . to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(e) and (f) (emphasis added). An environmental impact assessment that seeks to justify agency action even though its "most stringent" implementation results in an outcome unsustainable for life as we know it is unreasonable *per se*.[8] Therefore, even if NHTSA intends to present the same general NEPA analysis in connection with the MD/HD Vehicle rulemaking as it did in the LD Vehicle FEIS, we request, at a minimum, that it undertake a different analysis as well, as set forth below.

Specifically, NHTSA should not fail to perform an analysis that shows what it must do to curb emissions from MD/HD vehicles that proportionally contribute to reaching sustainable emissions targets because it has (erroneously) concluded that no actions by other nations to curb

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[6] Comments by the Center for Biological Research Re: Final Environmental Impact Statement, Corporate Average Fuel Economy Standards, Passenger Cars and Light Trucks, Model Years 2021-2016 (February 2010); Docket No. NHTSA-2009-0059, dated March 25, 2010.

[7] Joel B. Smith et al., *Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) "Reasons for Concern,"* PROC. OF THE NAT'L ACAD, SCL (Feb. 26, 2009) at 1, 5, *available at* http://www.pnas.org/content/early/2009/02/25/0812355106.abstract; IPPC WGII, 2007, *Climate Change 2007 – Impacts, Adaptation and Vulnerability Contribution of Working Group II to the Fourth Assessment Report of the IPCC,* at 11.

[8] The LD Vehicle FEIS' analysis did serve to prove that the LD Vehicle Rule's greenhouse gas reductions are insufficiently stringent. But the manner in which this conclusion was presented also created the incorrect impression that the environmental outcome would not change regardless of what course of action the agencies pursued. When the difference in the effects of all alternatives presented amounts to no more than mere single digits in parts per million of CO_2 concentrations or even fractions of a single digit in temperature and sea level rise, it appears that efforts to improve fuel efficiency beyond what the agency has presented would be futile and irrelevant. This line of reasoning is not far from what the Supreme Court condemned in *Massachusetts v. EPA,* when it took EPA to task for characterizing achievable greenhouse gas reduction measures as insignificant. *Massachusetts v. EPA*, 549 U.S. 497, 523-26 (2007). Thus, we request that in the forthcoming EIS, NHTSA refrain from justifying any decision not to demand truly maximum feasible fuel efficiency by depicting the ultimate outcome of all regulatory efforts as *de minimis,* and instead conduct a meaningful alternative analysis as suggested herein.

their greenhouse gas emissions to reach that same goal are reasonably foreseeable. NEPA and CEQ implementing regulations require NHTSA to consider the foreseeable actions of others: "CEQ regulations implementing the procedural provisions of NEPA define cumulative impacts as 'the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions.' 40 CFR 1508.7." LD Vehicle FEIS at 2-40. While we agree that the currently enacted regulations and the future policies and promises of third parties remain inadequate to address the problem, this does not allow NHTSA to avoid presenting alternatives that would lead MD/HV Vehicles to contribute their proportionate share of overall U.S. greenhouse gas reductions to avoid unsustainable environmental change.

III. NHTSA Must Consider Climate Tipping Points

As we pointed out in our Comment Letter, although the LD Vehicle FEIS devoted considerable space to the discussion of tipping points, it provided no quantitative analysis of their effects even on a cumulative basis, despite conceding that tipping points cannot be avoided. The result was that the costs of exceeding these points were left entirely out of the equation. In particular, NHTSA stated that it had not quantified these risks under either its direct-indirect or its cumulative analysis, claiming that "the present state of the art does not allow for quantification of how emission reductions *from a specific policy or action* might affect the probability and timing of abrupt climate change." LD Vehicle FEIS at 3-84, 4-49 (emphasis added). This justification cannot withstand scrutiny: under the cumulative impacts analysis, NHTSA need not quantify how increasing U.S. mileage standards alone would affect tipping points (indeed, no individual action by itself can halt GHG emissions sufficiently to avoid tipping points), when it can quantify the damages likely to arise from crossing them as a result of cumulative impacts. Instead, NHTSA assigned them a value of zero, a conclusion that is certain to be false.[9]

NHTSA possesses ample information to begin quantification of the tipping point risk, including the scientific literature cited here. The LD Vehicle FEIS discussed continental, sub-continental, regional and local effects of crossing tipping points, including dramatic alteration of the Asian monsoon; overturning of the circulation system in the Atlantic Ocean; the collapse of the West Antarctic ice sheet; the loss of the Greenland ice sheet; drying in the southwestern United States leading to drought and increases in fire frequencies; and loss of the Sierra Nevada snow pack. The LD Vehicle FEIS noted that such tipping points are characterized by rates of change sharply greater than what has prevailed over previous decades and change acceleration at a pace that exceeds the resources and ability of nations to respond to it. LD Vehicle FEIS, 4-155. It further pointed out that tipping points can occur at levels "exceeding 450 ppm" and that, while "future abrupt changes cannot be predicted with confidence, . . . climate surprises are to be expected." *Id.* at 4-156-157. The LD Vehicle FEIS also notes that, based on "'growing evidence that even modest increases in [global mean temperature] could commit the climate system to the risk of very large impacts on multiple-century time scales,' the risks of large-scale discontinuities were expertly judged to begin being a source of substantial risk around 1 °C

[9] This zero value was also reflected in the crucial but incorrect assumption contained in the underlying LD Vehicle Rule that the social cost of carbon increases by a linear and non-variable 3% per year over the next century. As the LD Vehicle FEIS' discussion made perfectly clear, there is no linearity in the effects of climate change.

(around 2 °F). Smith *et al*. (2008) projected 2.5 °C (4.5 °F) . . . to be the 'possible trigger for commitment to large-scale global impacts over multiple-century time scales.'" *Id.* at 4-157.

In other words, the best outcome the LD Vehicle FEIS described as resulting from its most stringent alternative and the "reasonably foreseeable" actions of other parties virtually commits the environment to massive, large-scale trigger points that cause changes to which we can no longer adapt. But, repeating the argument the Supreme Court rejected in *Massachusetts v. EPA*, the LD Vehicle FEIS concluded both that quantification of the effects of these developments is impossible and that nothing can be done:

> This action [setting mileage standards] alone, even as analyzed for the most stringent alternative, is very unlikely to produce sufficient CO2 emissions reductions to avert emission levels corresponding to abrupt and severe climate change. Under EPCA, as amended by EISA, NHTSA has the authority to set fuel economy standards for U.S. passenger cars and light trucks, which account for roughly 3.3 percent of global annual CO2 emissions. Even if NHTSA could set standards that reduced emissions from this sector to zero, tipping-point thresholds (whether they occur at 550 ppm or any other level of that general order of magnitude) would not likely be avoided without other significant global actions.

LD Vehicle FEIS at 4-165. While superficially correct, this statement cannot support the conclusion that NHTSA may avoid providing an analysis of how the rulemaking could proportionately reduce greenhouse gas emissions from MD/HD Vehicles, so as to contribute its proportionate share to an environmental outcome in which combined cumulative action results in sustainable CO_2 stabilization.

IV. The EIS Should Analyze What Must Be Done to Cut Emissions From MD/HD Vehicles to a Sustainable Level

We request that NHTSA perform a back-casting analysis of alternative fuel efficiency standards that either assumes that other actors also engage in conduct that avoids catastrophic climate change, or that disregards what others might to and focuses only on the U.S. proportionate responsibility. Specifically, NHTSA should determine the total greenhouse gas emissions reductions from MD/HD Vehicles that would allow the sector to reach its proportionate share of the maximum global allowable emissions necessary to reach atmospheric greenhouse gas concentrations low enough to avoid catastrophic climate change. That, in a nutshell, is what NEPA commands.[10] We request that the MD/HD Vehicle EIS include an analysis of the extent to which the proposed alternatives would contribute to a reduction of U.S. greenhouse gas emissions to 17% below 2005 levels by 2020, to 25- 40% below 1990 levels by 2020, and to 45% below 1990 levels by 2020. We also believe that NHTSA should project reductions reached by 2020, 2050, 2080 and 2100.

[10] The tools to perform this analysis exist. *See* LD Vehicle FEIS, 3-94, citing to Pacala and Socolow (2004).

V. NHTSA Should Perform An Unbiased Cost-Benefit Analysis

In the Comment letter as well as in its comments to the proposed LD Vehicle Rule,[11] the Center demonstrated that NHTSA's assumptions concerning costs and benefits were skewed against reaching the truly maximum feasible fuel efficiency standards that are mandated by law. In general, NHTSA systematically undercounted the enormous benefits resulting from increased fuel efficiency and overestimated the costs. Moreover, NHTSA's rulemaking did not result even in a situation where these undercounted benefits equaled the overestimated costs; rather, achievable benefits were left on the table. Discount rates were too high, payback periods too short, and NHTSA failed to assess the cost of, and much require, shorter vehicle redesign cycles. NHTSA also failed to assess the economic benefits of increased job creation resulting from speeding up the technology adaptation cycle. These comments are incorporated here by reference with the request that NHTSA avoid these issues in the forthcoming EIS. In addition, the scientific studies cited above lend additional support to the argument that the economic, environmental, social and other benefits of avoiding the effects of climate change have been severely understated in light of the fact that climate change effects have occurred sooner than anticipated, that tipping points are likely to occur within decades and not centuries and some may have occurred already, that climate commitment already exposes the Earth to irreversible effects, and that mitigation costs increase the longer they are delayed.

VI. NHTSA Should Present Alternatives That Are Truly Technology Forcing

In its Notice, NHTSA describes four alternative approaches (plus a business-as-usual or baseline approach) to achieving maximum fuel efficiency, each increasing in stringency by applying what appear to be currently available fuel efficiency improvement technologies to an increasing number of emission sources within the MD/HD Vehicles class (engines, tractors, trucks, and trailers). Given the urgency of the issue as demonstrated by the best available science, and given the statutory mandate that NHTSA achieve the "maximum feasible improvement", 442 U.S.C. § 32902(k)(2), it is inconceivable that Alternatives 2, 3 or 4 should be given any weight, and that anything less than Alternative 5 could be justified. We agree with the NAS Study's conclusion that "selectively regulating only certain vehicle classes would lead to very serious unintended consequences and would compromise the intent of the regulation," NAS Study at S-13, adding only that all vehicle classes as well as engines and trailers should be simultaneously regulated.

Moreover, the Center is concerned that none of the alternatives appear to be truly technology forcing, in that the forthcoming standards, even though they are some five years away from implementation, do not seem to anticipate technological improvements by setting performance standards in excess of what existing technologies can produce. In addition, the NAS Study cites to the significant fuel efficiency improvements that can be brought about by driver training and education. NAS Study at S-10. Setting standards higher than technological improvements alone can achieve will provide the incentive to put non-technological solutions

[11] Comments by the Center for Biological Diversity Re: Proposed Rulemaking To Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Proposed Rule, 74 Fed. Reg. 49454 (Sept. 28, 2009); EPA Docket ID No. EPA-H!-OAR-2009-0472; NHTSA-2009-0059 dated November 27, 2009.

such as these into practice.

VII. Other Comments

In response to specific requests for comments contained in the Notice, we believe that (a) NHTSA should evaluate environmental impacts in the following time frames: 2020, 2050, 2080 and 2100; and (b) that NHTSA's analysis should include potential upstream impacts (changes in fuel use and emissions levels resulting from the extraction, production, storage, and distribution of fuel).

V. Conclusion

We appreciate the opportunity to submit these additional comment and thank you for your consideration.

Sincerely,

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Attachment A

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ATTACHMENT C

Comments by Center re: Draft Environmental Impact Statement, Medium- and Heavy-Duty Fuel Efficiency Improvement Program, October 2010; Docket No. NHTSA-2010-0079
(January 3, 2010)

CENTER *for* BIOLOGICAL DIVERSITY

VIA UPLOAD TO DOCKET NO. NHTSA-2010-0079 at REGULATIONS.GOV

January 3, 2010

National Highway Traffic Safety Administration
Docket Management Facility, M-30
U.S. Department of Transportation, West Building
Ground Floor, Rm. W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590
Attn: NHTSA-2010-0079

Re: Draft Environmental Impact Statement, Medium- and Heavy-Duty Fuel Efficiency Improvement Program, October 2010; Docket No. NHTSA-2010-0079

The Center for Biological Diversity (the "Center") hereby submits the following comments to the Draft Environmental Impact Statement, Medium- and Heavy-Duty Fuel Efficiency Improvement Program (October 2010) ("DEIS"). On July 14, 2010, we also submitted comments to the Notice of Intent to Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program (75 Fed. Reg. 33565) (the July 2010 Comment Letter), and we incorporate it by reference as if fully set forth herein. The Center is a non-profit environmental organization dedicated to the protection of imperiled species, their habitats, and the environment through science, policy, and environmental law. The Center has over 315,000 members and online activists throughout the United States. These comments are filed on behalf of our members and staff with a vital interest in reducing greenhouse gas and other air pollutants.

We fully support NHTSA's and EPA's (the "Agencies")[1] efforts to curb greenhouse gas ("GHG") emissions from and improve the fuel efficiency of new medium- and heavy-duty on-highway vehicles and work trucks ("HD Vehicles") and appreciate the opportunity to submit comments on this DEIS. We thank the Agencies for taking our comments, including those to the recent light-duty vehicle rules, into account. However, the DEIS continues to contain a number of significant flaws. We submit the instant comments in hopes that they will further inform the

[1] For ease of reference, because both NHTSA and EPA contributed to the underlying rulemaking and influenced the DEIS, this comment letter generally addresses both agencies.

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Agencies' Final Environmental Impact Statement and the accompanying rulemaking.

In 2008, the CO_2 emissions from U.S. HD Vehicles constituted 22.4 percent of all greenhouse gas emissions from motor vehicles and engines. Emissions from HD Vehicles constitute the fastest growing source of U.S. greenhouse gas emissions, having increased by an astounding 68% since 1990, and they are projected to continue to increase.[2] Approximately 6.9% of total U.S. CO_2 emissions and 1.2% of total global emissions stem from U.S. HD Vehicles.[3] Because these emissions are closely related to the amount of fuel the vehicles consume, setting fuel efficiency standards at the maximum feasible level is among the most significant actions the U.S. government can take to reduce America's overall greenhouse gas emissions. Thus, it is imperative that the FEIS fully and effectively disclose the consequences of the proposed actions by means of meaningful comparisons and clear statements of their effects and consequences. We ask that the Agencies present and evaluate alternatives in a manner that allows the decision-makers and the public to understand and compare their impacts in the context of the role HD Vehicle fuel efficiency can play in combating climate change. Specifically, we note the following:

- The Agencies have not included alternatives that truly represent the maximum technologically feasible fuel efficiency improvement achievable during the rulemaking period, and have also rejected technology-forcing measures from consideration. We urge the Agencies to present and fully analyze such alternatives, a step we believe is mandated by the National Environmental Policy Act ("NEPA").

- The Agencies must fully account for the benefits arising from the greenhouse gas emission reductions and fuel efficiency improvements proposed in the alternatives, properly value the social cost of carbon, and account for tipping points. Although the costs of all of the alternatives presently discussed are already dwarfed by the benefits they achieve even under the limited accounting accomplished so far, the actual discrepancy is far greater. The Agencies cannot put their thumb on the cost-benefit analysis, and should not design rules that create *profits* for polluters while leaving a host of feasible, appropriate and cost-effective fuel efficiency programs crucial to mitigating climate change damages on the cutting room floor.

- The DEIS must analyze the alternatives it discusses in a manner that brings their true impact into sharp focus. To do so, it should analyze and discuss alternatives that contribute to the reduction of greenhouse gas emissions from HD Vehicles to levels that allow the U.S. to reduce its overall emissions proportionally to sustainable levels and thereby put the U.S. on a path that avoids climate calamity. We appreciate the Agencies' first step in this direction – their analysis showing that the proposed

[2] MEDIUM- AND HEAVY-DUTY FUEL EFFICIENCY IMPROVEMENT PROGRAM, DRAFT ENVIRONMENTAL IMPACT STATEMENT (Oct.2010), Summary at 19, *available at* www.nhtsa.gov/fuel-economy.
[3] *Id.*

alternatives not only fail to reach President Obama's goal of a 17% reduction below 2005 levels by 2020, but instead *increase* emissions by up to 13.6 percent over 2005 levels by 2020. However, the Agencies should now follow up by providing the complete proportional-reduction analysis we believe is required by the NEPA process.

- The DEIS should discuss alternatives that reduce black carbon emissions from HD Vehicles.

I. THE DEIS FAILS TO PRESENT AND DISCUSS A FUEL EFFICIENCY IMPROVEMENT ALTERNATIVE THAT INCORPORATES ALL TECHNICAL FUEL EFFICIENCY IMPROVEMENTS THAT CAN FEASIBLY BE IMPLEMENTED DURING THE RULEMAKING PERIOD

Because, under the applicable statutes, the proposed HD vehicle rule (the "HD Vehicle Rule")[4] must implement fuel efficiency standards that achieve *the maximum feasible improvement* in HD Vehicle fuel efficiency, the environmental impact statement for the rulemaking must, at a minimum, present, discuss, and analyze at least one alternative that actually incorporates all improvements that are technically feasible during the rulemaking period, including technology-forcing measures. The DEIS, however, does not present such an alternative, and therefore does not discuss the relevant environmental impacts its implementation would entail.

(a) The Applicable Standards

When Congress enacted the Energy Policy Conversation Act ("EPCA"), it specified its goals: to decrease the nation's dependence on foreign imports, to enhance national security and to achieve the efficient utilization of scarce resources.[5] To achieve these goals, EPCA, as amended by the Energy Independence and Security Act of 2007 ("EISA"), expressly demands that NHTSA set *maximum feasible* fuel economy standards.[6] In the case of HD Vehicles, Section 32902(k) of EPCA requires NHTSA to set standards and implement a HD Vehicle "fuel efficiency improvement program *designed to achieve the maximum feasible improvement*."[7] The requisite standards shall be "appropriate, cost-effective, and technologically feasible for commercial medium-and heavy-duty on-highway vehicles and work trucks."[8] Thus, while NHTSA must consider whether the standards it sets are appropriate for the vehicles at issue, are cost-effective, and are technologically feasible, the resulting standards cannot fail to deliver "the maximum feasible improvement."[9]

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[4] GREENHOUSE GAS EMISSIONS STANDARDS AND FUEL EFFICIENCY STANDARDS FOR MEDIUM- AND HEAVY-DUTY ENGINES AND VEHICLES; PROPOSED RULE (Nov. 30, 2010), 75 Fed. Reg. 74152 (the "HD Vehicle Rule," or "NPRM").
[5] *Center for Biological Diversity v. NHTSA*, 508 F.3d 508, 514 (9th Cir. 2007).
[6] 49 U.S.C. § 32902(a).
[7] *Id.*, § 32902(k)(2) (emphasis added).
[8] *Id.*
[9] *Id.* EPA's authority to set standards is derived from Section 202(a) of the Clean Air Act, 49 U.S.C. § 7521(a)(3)(A)(i).

Center for Biological Diversity v. NHTSA established that, in fulfilling its duties under Section 32902(a), NHTSA "cannot set fuel economy standards that are contrary to Congress's purpose in enacting the EPCA – energy conservation," it cannot act arbitrarily and capriciously; it cannot advance conclusions unsupported by the evidence; if it conducts cost-benefit analyses, it may not assign values of zero to benefits that can be ascertained within a range; and it cannot bias its cost-benefit analysis.[10] Section 32902(k) imposes the same requirements. In addition, fuel efficiency standards under EPCA and EISA must be technology-forcing.[11] The HD Vehicle Rule, in expressly limiting itself to the application of technology that is already commercially available today, fails to achieve this mandate.

The Environmental Impact Statement ("EIS") accompanying a rulemaking under EPCA, EISA, and the Clean Air Act must therefore include at least one alternative that does encompass the maximum technologically feasible improvement achievable, must include technology-forcing measures, and must bring their environmental impact (and those of other alternatives discussed), into sharp focus. As stated by the Counsel for Environmental Quality's regulations concerning the requisite process under the National Environmental Policy Act ("NEPA"),

> Based on the information and analysis presented in the sections on the Affected Environment . . . and the Environmental Consequences . . . [an EIS] should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public.[12]

Even alternatives the Agencies eventually discard as unreasonable must be discussed, and the reasons for their having been eliminated must be explained.[13] Lastly, the Agencies must identify their preferred alternative, and bring into focus why they believe that alternative delivers the maximum feasible improvement achievable in light of the environmental impacts, costs and benefits at stake.[14]

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[10] *Center for Biological Diversity v. NHTSA, supra*, 508 F.3d at 531, 534.

[11] EPCA and EISA are meant to encourage technological innovation in the field, not simply promote the wider adoption of existing technologies. *See, e.g., Center for Auto Safety v. Thomas*, 847 F.2d 843, 870 (D.C. Cir. 1988) (overruled on other grounds) ("[t]he experience of a decade leaves little doubt that the congressional scheme in fact induced manufacturers to achieve major technological breakthroughs as they advanced towards the mandated goal"); *Green Mt. Chrysler Plymouth Dodge Jeep v. Crombie*, 508 F. Supp. 2d 295, 358-359 (D. Vt. 2007) (discussing technology-forcing character of EPCA and the use of increased fuel efficiency to augment performance rather than mileage): *Kennecott Greens Creek Min. Co. v. Mine Safety and Health Admin.*, 476 F.3d 946, 957 (D.C. Cir. 2007) ("when a statute is technology forcing, the agency can impose a standard which only the most technologically advanced plants in an industry have been able to achieve – even if only in some of their operations some of the time"). The Clean Air Act is similarly technology-forcing. Legislative history indicates that the primary purpose of the Act was not "to be limited by what is or appears to be technologically or economically feasible," which may mean that "industries will be asked to do what seems impossible at the present time." 116 Cong. Rec. 32901-32902 (1970), Legislative History of the Clean Air Amendments of 1970 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-18, p. 227 (1974); *see also Whitman v. American Trucking Association*, 531 U.S. 457, 491 (2001).

[12] 40 C.F.R. § 15002.14; *see also* DEIS at 2.20.

[13] 40 C.F.R. § 15002.14(a).

[14] 40 C.F.R. § 15002.14(e); the DEIS does not provide that analysis (although the proposed rulemaking does, NPRM, 75 Fed. Reg. 74156).

For HD Vehicles, technologies exist or can feasibly be developed *within the rulemaking period* to reduce emissions up to 50% in model year 2017. The DEIS should analyze and discuss the alternatives that can reach that result, even if they are not the Agencies' preferred alternative. In each case, the amount of reductions in emissions of greenhouse gases and other pollutants and the fuel savings left on the cutting table because a more efficient alternative was not chosen should be clearly identified and monetized.

The need to discuss a truly technology-forcing alternative that includes all technologies that exist or can be developed during the rulemaking period is especially urgent since, as the Agencies point out, vehicle miles traveled ("VMT") are expected to continue to increase during the rulemaking period, and indeed more than offset the fuel efficiency gains projected under all of the alternatives the Agencies have so far chosen to analyze.[15] The Agencies' analysis showing that even the most stringent alternative they have so far considered *increases* greenhouse gas emissions by up to 13.6 percent in 2020 underscores the fact that the HD Vehicle Rule fails the legislative mandate. We urge the Agencies to remedy this defect in the Final Environmental Impact Statement ("FEIS") (and final HD Vehicle rule).

(b) Technologies Exist or Can Be Implemented During the Rulemaking Period That Can Improve Fuel Efficiency Gains By Up To 50%

Technologies exist, or can feasibly be developed and implemented during the rulemaking period, that are appropriate for HD Vehicles and that can sharply increase their fuel efficiency gains. As will be discussed below, because the benefits of these technologies are extremely likely to outweigh their costs by orders of magnitude under any accurate cost-benefit accounting, alternatives implementing such technologies will also prove to be highly cost effective (and may even prove to be profitable). The DEIS should therefore include alternatives incorporating these technologies and analyze their environmental impacts.

(1) Trailer Fuel Efficiency Improvements

In the NPRM, the Agencies have tentatively decided not to apply fuel efficiency improvements to trailers used with Class 7 and Class 8 tractors, *not* because these technologies are unavailable, but because of the diversity of trailer manufacturers and models and manufacturers' inexperience with fuel efficiency regulations.[16] These reasons for rejecting trailer regulations cannot withstand scrutiny: not only do they have no relation to the factors the Agencies must consider under Section 32902(k) (appropriateness for the vehicles at issue, cost effectiveness, and technical feasibility), but they deliberately ignore those factors. Not utilizing readily available fuel improvement technologies for Class 7 and Class 8 tractor trailers is especially egregious because these vehicles consume the largest fraction of fuel among the HD Vehicle category.[17]

Indeed, the Agencies themselves recognize the many presently existing opportunities for

[15] DEIS at 2-26. As the DEIS points out, EPA's criteria pollutant regulations have decreased total pollution by up to 97 percent even while vehicle miles traveled have continued to increase.
[16] NMRP, 75 Fed Reg. 74346-74351.
[17] DEIS at 2-9.

improvements in trailer fuel efficiency, including aerodynamic drag, rolling resistance, and overall weight, and cite studies showing that fuel consumption could be reduced by up to 18 percent through improved aerodynamics and tire resistance alone.[18] The Agencies further recognize that, as stated in the relevant National Academy of Sciences report, the trailer market's split incentives present a clear barrier to market forces alone driving fuel improvement, providing even greater impetus for taking regulatory action as quickly as possible. The Agencies' analysis and discussion of the feasibility, cost-effectiveness, and availability of fuel efficiency improvements for trailers makes a compelling case for the implementation of such regulations, and, contrary to the Agencies' assertions otherwise, demonstrate the Agencies' expertise in the subject matter. The claim that the industry should not yet be regulated because it has not already "been subject to either emissions or fuel economy regulations"[19] obviously misses the mark, as that claim will be as true five years from now, or indeed at any time in the future, as it is at present *unless* regulation in fact begins. The Agencies are *obligated* by statute and Presidential directive to devise and implement fuel efficiency regulations, and the fact that regulation has not yet commenced cannot be cited as the reason for not commencing it.[20] Lastly, while the trailer manufacturing industry might be fractionated and complex, so is the HD Vehicle industry as a whole, and yet the Agencies have been able to devise efficiency standards. In short, there is no excuse for the failure to commence trailer fuel efficiency improvement regulations as part of the final HD Vehicle rule.

Although the DEIS models improvements available through trailer regulations in Alternatives 7 and 8, these alternatives fail to include other available technologies, as discussed below. An alternative that combines all technologies in existence now and that will become available with proper incentives during the regulatory period, including those pertaining to trailers, should be added to the FEIS.

(2) Bottom Cycle Technology

Bottom cycling is an emerging technology that can provide significant reductions in CO_2 emissions compared with many other technology options. A bottoming cycle is a system of "waste heat recovery" in which heat that is generated as a byproduct of providing power to run a vehicle is captured and used to drive a secondary turbine to create more energy.[21] The potential for bottoming cycle emissions reduction is greater than that of many other technologies or configurations. The fuel savings are comparable to the fuel savings for a parallel electric hybrid powertrain at two-thirds of the cost. In comparison to other technologies that use or reduce

[18] *Id.* For other studies demonstrating that the emission reductions contemplated by the rulemaking are well below the maximum feasible level, *see* Nicholas Bianco and Franz Litz, *Reducing Greenhouse Gas Emissions in the United States Using Existing Federal Authorities and State Action,* WORLD RESOURCES INSTITUTE REPORT (July 2010), ISBN 987-1-56973-749-1; National Research Council, Committee to Assess Fuel Economy Technologies for Medium- and Heavy-Duty Vehicles, *Technologies and Approaches to Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles* (2010), *available at* www.nap.edu/catalog/12845.html.

[19] *Id.* at 75 Fed. Reg. 74350.

[20] In addition, the claim is incorrect. As the Agencies themselves note, California already requires trailers to reduce greenhouse gas emissions. *Id.*

[21] Northeast States Center for a Clean Air Future, International Council on Clean Transportation, et al., REDUCING HEAVY-DUTY LONG HAUL COMBINATION TRUCK FUEL CONSUMPTION AND CO_2 EMISSIONS ("NESCAAF/ICCT report") at 55; DEIS at 2-15.

waste heat, bottoming cycles are far superior: a mechanical turbocompound can reduce CO_2 emissions by 2.9%; electrical turbocompound by 4.2%; variable valve actuation by 1%; and advanced exhaust gas recirculation by 1 to 2%.[22] In contrast, a bottoming cycle can reduce CO_2 emissions by up to 10%.[23]

Although bottoming cycle technology has not yet been used in vehicles, it is common in power plants.[24] Moreover, a recent report by the Northeast States Center for a Clean Air Future and the International Council on Clean Transportation ("NESCCAF/ICCT report") clearly considers the bottoming cycle a viable future technology that can feasibly be implemented in 2017, and includes a bottoming cycle in two of the emissions reductions "packages" simulated to show what level of whole-vehicle reductions are possible. One way to accelerate implementation is to use a less aggressive bottoming cycle that would be easier and cheaper to achieve by 2017, with a CO_2 reduction potential of 8%.[25] The NPRM also notes that a report to the National Academy of Sciences panel reviewing fuel efficiency improvement opportunities for HD Vehicles included waste heat recovery in the engine package for MD 2016-2020.[26]

The NPRM has so far concluded, despite these studies, that bottom cycling will not be ready for production by the 2017 model,[27] and has therefore excluded it from the rulemaking. This reasoning cannot withstand scrutiny: exclusion is sure to result in a standard that represents less than the "maximum feasible" improvement, even though the technology is (a) technically feasible within the rulemaking's time frame, (b) appropriate for the vehicle, and (c) cost effective (*see* discussion below). Even if presently some measure of doubt exists as to whether the technology can be fully implemented by 2017, the technology-forcing mandates of EPCA, EISA and the Clean Air Act urge its inclusion.

But regardless of the final decision the Agencies will make in the rulemaking, the DEIS must include bottom cycling as part of a presentation of a truly "maximum feasible" efficiency improvement option, along with all other such fuel improvement technologies. Omission of these technologies from consideration deprives the decision-maker and the public of the opportunity to fully assess the environmental impacts that could be avoided, and the benefits in improved fuel efficiency and reduced pollution that could be achieved, and thus runs counter to NEPA's mandate.

(3) Other Available Fuel Efficiency Improvement Technology

According to the NESCCAF/ICCT report, heavy-duty long haul truck emissions could be reduced by up to 50% in MY 2017 though a combination of technologies (e.g., aggressive aerodynamics and rolling resistance reductions, parallel hybrid powertrain, bottoming cycle, Rocky Mountain double trailer, and a 60 mile-per-gallon governor).[28] (Some of these

[22] NESCCAF/ICCT report at 54-55, Tables 11-13.
[23] Id. at 50.
[24] Id. at 31, 88.
[25] Id. at 56, Table 2.
[26] The NPRM refers to TIAX, LLC. ASSESSMENT OF FUEL ECONOMY TECHNOLOGIES FOR MEDIUM- AND HEAVY-DUTY VEHICLES, NOVEMBER 2009, 75 Fed. Reg. 74247.
[27] NPRM, 74 Fed. Reg. 74247.
[28] NESCCAF/ICCT Report at 64-65.

technologies are also feasible for other segments within the HG Vehicle category.) The NESCCAF/ICCT report indicates that this package falls within a "reasonable technological risk," and over a 15-year payback period owners would reap a cost savings of $42,000 (assuming a fuel price of $2.50/gal).[29] The payback period for the 50% reduction package ("Package 14") is stated at 4.7 years.[30] Although these technologies exist or can feasibly be deployed by 2017 to reduce emissions of long-haul tractor trailers up to 50%, the Agencies have rejected many of them, including hybrid powertrains,[31] idle reduction technologies,[32] use of double trailers,[33] and bottoming cycles.[34] Instead, the Agencies state they plan to utilize only technologies that are currently available. [35] As stated above, this approach ignores the statutory mandate to devise a standard that represents maximum feasible improvements and is technology forcing.

We note that in rejecting consideration of the 60 mile-per-gallon speed regulator, the Agencies have indicated that they believe they lack the statutory authority to require manufacturers to reduce vehicle speed.[36] However, the statute contains no such restriction. Instead, it instructs NHTSA to examine the fuel efficiency of HD Vehicles and determine "the range of factors, including, without limitation, design, functionality, use, duty cycle, infrastructure, and total overall energy consumption and operating costs that affect [HD Vehicles'] fuel efficiency," [37] and then to implement "fuel economy standards" that are "appropriate, cost-effective, and technologically feasible" for HD Vehicles. [38] Speed undoubtedly is a "factor" in fuel efficiency, and a speed regulator is a technology that is feasible (and already in use), cost effective, and appropriate, and will create immediate and significant fuel efficiency gains. But even if the Agencies simply require a regulator set at existing maximum speed limits to avoid any jurisdictional concerns, speeding and its attending fuel consumption would be eliminated. We urge the Agencies to reconsider their position and adopt a speed limitation technology.

Further, we note that, while the Agencies have rejected technologies such as bottom cycle engines, hybrid drive trains and full electric vehicles because they are not currently available for HD Vehicles, they have included other technologies, such as advanced exhaust gas recirculation which still faces some technological hurdles before it can be implemented.[39] We urge the Agencies to implement in the later model years of the rulemaking all technologies reasonably estimated to be ready for implementation at that time.

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[29] Id. at Figure 17.
[30] NESCCAF/ICCT report at Table 2.
[31] DRAFT REGULATORY IMPACTS ANALYSIS, PROPOSED RULEMAKING TO ESTABLISH GREENHOUSE GAS EMISSIONS STANDARDS AND FUEL EFFICIENCY STANDARDS FOR MEDIUM- AND HEAVY-DUTY ENGINES AND VEHICLES (Oct. 2010) at 2-54, *available at* www.nhtsa.gov/fuel-economy.
[32] Id. at 2-51 (stating that a credit system will be used for idle reduction technologies instead of building them into the standards).
[33] Id. at 2-85, 2-86.
[34] Id. at 2-29.
[35] NPRM, 75 Fed. Reg. 74165.
[36] DEIS, 75 Fed. Reg. at 1-14.
[37] 49 U.S.C. § 32902(k)(1)(C).
[38] 49 U.S.C. § 32902(k)(2).
[39] ICCT report at 62.

However, as stated above, regardless of the final decision taken, the EIS must present all reasonable alternatives and their environmental impacts. This is especially true with regard to the cumulative impact analysis, as it requires the Agencies to reflect reasonably foreseeable future actions. The fuel usage in years after the current rulemaking is assumed to follow the business-as-usual prediction contained in the EIA's Annual Energy Outlook until 2035, after which no improvements of any kind are assumed. This assumption neglects technologies such as those mentioned above that would provide significant fuel economy improvements in the near future. In other words, even if the Agencies do not select technologies that allow for significant emissions reductions within the regulatory timeframe, the Agencies should describe these available and foreseeable reductions as part of the cumulative impacts analysis under NEPA.

II. THE DEIS UNDERSTATES THE ENVIRONMENTAL BENEFITS OF GREENHOUSE GAS REDUCTIONS AND FUEL EFFICIENCY IMPROVEMENTS

We appreciate the Agencies' efforts to improve the DEIS' description of the environmental impacts of climate change in its direct, indirect, and cumulative analyses of the HD Vehicle Rule. Nonetheless, the DEIS continues to understate the benefits to be derived from reducing greenhouse gas pollution from these vehicles in drastic ways. Although it is clear that the costs of any of the alternatives discussed are lower than their stated benefits by orders of magnitude, the actual discrepancy is even more dramatic. The failure to correctly portray the cost-benefit calculation involved in demanding higher fuel efficiency standards prevents decision-makers and the public from fully comprehending the consequences of the actions at issue, and thus violates NEPA.[40]

(a) The Social Cost of Carbon Is Understated

We applaud the Agencies for the fact that in contrast to the environmental impact statements prepared for earlier vehicle fuel economy standard rulemakings, the DEIS now accounts for upstream as well as downstream carbon emissions. The DEIS has also been improved by including a modest (though insufficient) factor by which the social cost of carbon ("SCC") increases over time.[41] However, that increase is offset by the application of a discount rate in all models, a highly questionable exercise where intergeneration transfer issues such as those involved in climate change are at play. In addition, as discussed below, it fails to account for the crossing of tipping points.

Moreover, although the DEIS now includes estimates of the SCC ranging up to $66 per metric ton of CO_2, all estimates, including those that arrive at a central value of $22/ton, rely on the work of the Interagency Working Group on the Social Cost of Carbon.[42] Recent scientific

[40] *See, e.g., Center for Biological Diversity v. NHTSA*, 503 F.3d at 531, 534.

[41] The adjustments in value fail to capture the true nature of the increase in SCC over time. As we stated in the July 2010 Comment Letter, studies have shown that delaying mitigation drastically, and possibly irreversibly, increases climate risks and/or long-term costs. In other words, mitigation measures available now that are *not* implemented because of cost concerns will become much more costly at a later time and, if tipping points are reached, will be unable to alter irreversible damage. For further details, we refer the Agencies to our July 2010 Comment Letter.

[42] TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866, Interagency Working Group on Social Cost of Carbon (EPA 2010).

literature demonstrates that the assumptions underlying that work are highly questionable and significantly undervalue the SCC value.[43] For example, Ackerman and Stanton (2010) present a critique of the Interagency Working Group's methods and conclusions, including the use of only three flawed models, FUND, PAGE, and DICE, to estimate the SCC.[44] The Interagency Working Group also relied heavily upon flawed Richard Tol's 2009 meta-analysis of estimates of the SCC, which is in fact a highly personal view of the economics literature, with a strong emphasis on Tol's own work. At the same time the Interagency Working Group ignored the Stern Review of the Economics of Climate Change, due only to a limitation to peer-reviewed published literature, ignoring the fact that the Stern Review offered an innovative, rigorous analysis based on a level of professional review that went far beyond the normal peer review process for articles published in academic journals. Overall, the Interagency Working Group's administration's narrow proposed range of SCC values, with a likely "central" estimate of $22, is a function of its choice of a limited range of underlying studies, high discount rates, and insufficient emphasis on the risk of catastrophic climate damage, and contrasts sharply with the United Kingdom's estimated carbon pricing in the rage of $41-$124 per ton of CO_2, with a central case of $83. While cost-effectiveness is one statutory factor the Agencies must consider, the multiple problems inherent in the current SCC estimate highlight the need not only for a more credible monetary analysis, but also the need for a more comprehensive discussion of the true impacts of climate change, a topic which ultimately cannot be captured by economic models or dollar figures alone.

In addition, the calculations of the SCC suffer from a defect so fundamental as to render the analysis fatally defective: the SCC estimates are calculated only through 2050, even though other elements of the climate change analysis extend through 2100, and even though the DEIS overall portrays itself as providing a reasonable estimate of damages through that year.[45] This defect is all the more significant because the damages caused by CO_2 emissions last for centuries, if not millennia, and dramatically *increase* after 2050. In other words, the most significant social costs of carbon are simply left out. A cost-benefit analysis that fails to account for years after 2050, during which the planet will experience much higher temperatures and therefore the most devastating damages caused by global warming, cannot withstand scrutiny. We urge the Agencies to remedy this flaw in the FEIS.

We also wish to draw the Agencies' attention to a number of new studies relevant to the catastrophic effects of climate change that will occur at the CO_2 stabilization level for 2100 (678 ppm) postulated within the DEIS.[46] For instance, one study analyzes how the increase in

[43] The Agencies themselves note several critical shortcomings of the assumptions underlying the SCC estimates, nearly of which dramatically *decrease* the SCC value: "the incomplete way in which the integrated assessment models capture catastrophic and non-catastrophic impacts, their incomplete treatment of adaptation and technological change, uncertainty in the extrapolation of damages to high temperatures, and assumptions regarding risk aversion." DEIS at 3-91.

[44] Ackerman, F., and E. Stanton, *The Social Cost of Carbon*, A REPORT FOR THE ECONOMICS FOR EQUITY AND THE ENVIRONMENT NETWORK (2010), *available at* www.e3network.org/papers/SocialCostOfCarbon_SEI_20100401.pdf.

[45] DEIS at 3-91.

[46] *See* Steven C. Sherwood & Matthew Huber, *An adaptability limit to climate change due to heat stress*, 107 PNAS 9552 (May 2010). "A global-mean warming of only 3–4 °C would in some locations halve the margin of safety (difference between T_W max and 35 °C) that now leaves room for additional burdens or limitations to cooling. Considering the impacts of heat stress that occur already, this would certainly be unpleasant and costly if not

humidity in regions with high average temperatures will impact human habitability, focusing on heat stress as a function of "wet bulb" temperature. Estimates indicate that with 7°C warming, areas of the earth will exceed wet bulb temperatures to which humans and other mammals are physically capable of adapting, rendering these regions *uninhabitable*. The costs of these devastating impacts should be included in damage estimates and inform policy decisions regarding dangerous levels of climate change.

In addition, the truncated SCC analysis also omits the damages caused by gases other than CO_2 emissions. Since the Agencies have determined that this omission affects the calculations by understating damages by approximately 5%, this flaw should be easily corrected. Lastly, the DEIS acknowledges that it "probably underestimated the total criteria pollutant benefits,"[47] omits analysis of the environmental benefits available from regulating recreational vehicles,[48] fails to quantify the effect on resources such as water and biological resources, and ascribes no value to the human safety and health benefits derived from greenhouse gas emission reductions.[49] The cumulative effect of these decisions is to fatally undervalue the cost-benefits analysis.

(b) Damages Inflicted by Crossing Tipping Points Are Not Monetized

As stated by the Agencies, in the context of climate change and its consequences, the phrase "tipping point" is used "to describe situations in which the climate system . . . reaches a point at which there is a disproportionately large or singular response in a climate-affected system as a result of a moderate additional change in the inputs to that system (such as an increase in the CO_2 concentration). Exceeding one or more tipping points . . . could result in abrupt changes in the climate or any part of the system. Abrupt climate changes could occur so quickly and unexpectedly that human systems would have difficulty adapting to them."[50] In response to the Center's July 2010 Comment Letter requesting the Agencies to analyze and monetize the effect of crossing climate change tipping points, however, the Agencies stated:

> Due to the uncertainty surrounding the precise global temperature change or CO_2 concentration level that would constitute a tipping point, however, it is not currently practicable to estimate quantitatively how this action could delay or mitigate the triggering of tipping points. NHTSA does not believe that examining the alternatives in relation to reaching tipping points triggered by CO_2 emissions is possible at this time, as NHTSA cannot relate the reductions in CO_2 emissions, sea-level rise, precipitation changes, and temperatures to tipping-point thresholds or determine to what extent the different alternatives would affect tipping

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debilitating." *Id.* at 9554. THE ROYAL SOCIETY, *Four degrees and beyond: the potential for a global temperature increase of four degrees and its implications*, Vol. 369 (Jan. 13, 2010), *available at* http://rsta.royalsocietypublishing.org/content/current/. For a recent study on the costs of storm surges in the U.S. by 2030, *see* R.N. Hoffman et al., *An estimate of increases in storm surge risk to property from sea level rise in the first half of the twenty-first century*, WEATHER, CLIMATE AND SOCIETY (2010), doi: 0.1175/2010WCAS1050.1 (pre-publication version).

[47] DEIS at 3-28.

[48] DEIS at 3-3 n.2.

[49] *See* DEIS at 2-21.

[50] DEIS at 3-97, 3-98.

points.[51]

This response misses the point. Under the analysis presented in the DEIS, global CO_2 concentration levels are forecasted to reach 678 ppm. At those levels, climate tipping points will very likely have been exceeded, a probability level well within the Agencies' obligations to analyze and examine. The Agencies acknowledge this point themselves, as they state that "[s]everal . . . systems (loss of Arctic sea ice, Indian summer monsoon disruption, Sahara/Sahel and West African monsoon changes, drying of the Amazon rainforest, and warming of the boreal forests) . . . could reach a tipping threshold within this century."[52]

There can be no dispute that it is reasonably foreseeable that, at 687 ppm, tipping points will have been crossed. A recent study has conducted a comprehensive review of nine tipping elements in the Earth's climate system considered vulnerable to passing a tipping point in this century.[53] Tipping points for two tipping elements – the Arctic summer sea ice and the Greenland ice sheet – were considered vulnerable to being triggered at mean global temperature increase of less than 2°C above 1980-1999 levels. Since a 678 ppm level would lead to 2.56°C mean global temperature rise by 2100 according to the DEIS relative to 1980-1999 levels,[54] it is extremely likely that these tipping points will have been crossed at 678 ppm. In the case of the Greenland ice sheet, the triggering of irreversible melting by 1-2°C temperature rise above 1980-1999 levels would lead to an eventual seven-meter sea-level rise with catastrophic impacts.[55] Another study reviewing the expert judgments of 43 scientists found that they allocated significant probabilities to triggering tipping points for five systems at mean global temperature change of 2–4 °C above year 2000 levels, including the dieback of the Amazon rainforest, the shutdown of the Atlantic Ocean thermohaline circulation, the disintegration of the West Antarctic ice sheet, and a shift to a more persistent El Niño regime.[56] This study indicates that there is a significant probability of surpassing tipping points for these systems by or before reaching 678 ppm.

Finally, many ecosystems also have a high probability of exceeding tipping points well before 678 ppm, leading to ecosystem collapse and mass species extinction. The IPCC concluded that approximately 20 to 30% of species assessed will likely be at increased risk of extinction if global average temperature rise exceeds 1.5 to 2.5°C (relative to 1980-1999).[57] Due to the synergistic impacts of ocean acidification and mass bleaching from ocean temperature rise, coral reefs are projected to experience "rapid and terminal" declines worldwide at atmospheric CO_2 concentrations of 450 ppm.[58] Another study determined that ocean acidification would have

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[51] DEIS at 1-15.
[52] DEIS at 4-113.
[53] Lenton, T. M. et al., *Tipping elements in the Earth's climate system*, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (2008) at 105:1786-1793.
[54] DEIS at 4-68.
[55] Lenton, T. M. et al., *supra.*
[56] Kriegler, E. et al., *Imprecise probability assessment of tipping points in the climate system*, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES at 106(13): 5041-5046 (2009).
[57] International Panel on Climate Change, *Climate Change 2007: Synthesis Report, Summary for* Policymakers at 54 (2007) [IPCC Fourth Assessment Report (AR4)], *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm.
[58] Veron, J.E. et al., *The coral reef crisis: the critical importance of <350 ppm CO_2*, MARINE POLLUTION BULLETIN at 58: 1428-1436 (2009).

detrimental effects on plankton at the base of the food web in the Southern Ocean at CO_2 levels of 450 ppm, and proposed a tipping point of 450 ppm for this ecosystem.[59] Other scientists have found that CO_2 levels below 350 ppm are needed to protect coral reef ecosystems from collapse.[60]

In any event, uncertainty about quantification of the effect of one specific action – here, the adoption of the HD Vehicle Rule – is no obstacle: under the cumulative impacts analysis, the Agencies need not quantify how increasing U.S. mileage standards alone would affect tipping points (indeed, no individual action by itself can halt GHG emissions sufficiently to avoid tipping points), when they can quantify the damages likely to arise from crossing them as a result of cumulative impacts. At present, the Agencies have in effect assigned a value of zero to the cost of crossing tipping points, a conclusion that is certain to be false. Instead, the DEIS, as part of its cumulative analysis, must describe and quantify the impact of the climate's having crossed tipping points in 2100, even if the Agencies believe they cannot quantify the crossing of these thresholds as the direct or indirect result of the HD Vehicle rulemaking alone. As discussed above, however, we note that in the Agencies need to analyze whether the proposed action contributes its proportional share to a solution that avoids tipping points. One can infer that it does not do so from the fact that emissions from the HD sector will actually increase under the proposed action, but the DEIS needs to squarely confront this issue.

(c) Damages Caused by Ocean Acidification Are Not Considered or Monetized

Several recent findings relevant to ocean acidification, including the additive effects of ocean acidification and other stressors, have apparently not been considered by the Agencies. A recent study examined the ecological stress of ocean acidification in areas of low oxygen (also known as "dead zones"), concluding that the additive effects of these stressors "may cross critical thresholds for organisms living near the edge of their physiological tolerances and may thus appear as abrupt and major changes in the health of an ecosystem."[61] Ocean acidification also exacerbates coral bleaching as high-CO_2 waters act synergistically with increased temperature to lower the threshold for coral bleaching.[62] It is crucial that the ecological consequences of ocean acidification be considered in the context of other stressors because pH changes that may not reach a dangerous threshold for calcification may nonetheless wreak havoc on an ecosystem already under duress from other factors.

The DEIS focuses largely on impacts to marine calcifiers and includes discussion of impacts on marine fish and mammals.[63] These impacts, however, are likely to be broader than indicated in the DEIS. For instance, high partial pressures of CO_2 can detrimentally affect "acid-

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[59] McNeil, B.I, and R.J. Matear, *Southern Ocean acidification: A tipping point at 450-ppm Atmospheric CO2,* Proceedings of the National Academy of Sciences at 105: 18860-18864 (2008).
[60] Veron, J.E. et al., *supra;* Hansen, James, et al., *Target atmospheric CO_2: Where should humanity aim?*, OPEN ATMOSPHERIC SCIENCE JOURNAL at 2: 217-231 (2008).
[61] R.A. Feely et al., *The combined effects of ocean acidification, mixing, and respiration on pH and carbonate saturation in an urbanized estuary*, 88 ESTUARINE, COASTAL AND SHELF SCIENCE 442, 447 (2010).
[62] K.R.N. Anthony et al., *Ocean acidification causes bleaching and productivity loss in coral reef builders*, 105 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 17442 (2008).
[63] EPA and NHTSA, MEDIUM- AND HEAVY-DUTY FUEL EFFICIENCY IMPROVEMENT PROGRAM DRAFT ENVIRONMENTAL IMPACT STATEMENT 4-124 (October 2010).

base regulation, calcification and growth [as well as] respiration, energy turnover and mode of metabolism."[64] Another recent study suggests that although a single organism may be able to nominally survive in elevated CO_2 conditions, populations may not.[65] In fact, the authors suggest that elevated marine CO_2 may have resulted in mass extinctions in the past. Other reviews and studies have further elucidated the negative impacts of high levels of CO_2 in seawater with regard to cardiac mortality in fish[66] and growth and reproduction in marine organisms.[67] Finally, it should be noted that the threshold for detrimental physiological impacts on many marine organisms is relatively low.[68] The DEIS fails to consider or analyze these greenhouse gas pollution damages.

In sum, as stated in *Center for Biological Diversity v. NHTSA*, "[e]ven if NHTSA may use a cost-benefit analysis to determine the 'maximum feasible' fuel economy standard, it cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."[69] As outlined above, the DEIS drastically undervalues the benefits of greater fuel economy reductions. We request that the Agencies perform a full benefits analysis in the FEIS.

On the other side of the coin, the initial outlays required to implement the fuel efficiency improvements recommended by the Agencies are minimal, and in fact, "overall cost per ton of the rule, considering fuel savings, is *negative - fuel savings associated with the rule more than offset projected costs by a wide margin*."[70] In fact, "the application of fuel-saving technologies in response to the proposed standards would, on average, *yield private returns to truck owners of 140% to 420%*."[71] In other words, the proposed rulemaking will actually *increase the profits* of the regulated entities. This result belies the Agencies' conclusion that further improvements in fuel economy are not feasible. The Agencies have yet to describe and analyze an alternative that combines all feasible technological improvements, including all feasible technology-forcing measures; to calculate the costs of that alternative; and to correctly state its benefits. Thus, it remains impossible to assess the true cost-effectiveness of such an alternative, though continuing increases in fuel efficiency could still more than pay for the slightly increased costs. However, the vast gap between the cost outlays and the tremendous benefits to be reaped leaves no doubt that much greater regulatory stringency can be achieved without beginning to affect cost-effectiveness.

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[64] H.O. Pörtner et al., *Biological Impact of Elevated Ocean CO_2 Concentrations: Lessons from Animal Physiology and Earth History*, 60 JOURNAL OF OCEANOGRAPHY 705 (2004).
[65] Id.
[66] A. Ishimatsu et al., *Effects of CO_2 on Marine Fish: Larvae and Adults*, 60 JOURNAL OF OCEANOGRAPHY 731 (2004).
[67] C. Turley et al., Chapter 8: Reviewing the Impact of Increased Atmospheric CO_2 on Oceanic pH and the Marine Ecosystem, in AVOIDING DANGEROUS CLIMATE CHANGE 65 (2006); P.M. Haugan, C. Turley and H.O. Pörtner, *Effects on the Marine Environment of Ocean Acidification Resulting from Elevated Levels of CO_2 in the Atmosphere*, OSPAR Commission Report (2006).
[68] H.O. Pörtner et al., *Synergistic effects of temperature extremes, hypoxia, and increases in CO_2 on marine animals: From Earth history to global change*, 110 JOURNAL OF GEOPHYSICAL RESEARCH C09S10 (2005).
[69] *Center for Biological Diversity v. NHTSA*, 505 F.3d at 530-31.
[70] NPRM, 75 Fed. Reg. at 74226.
[71] NPRM, 75 Fed. Reg. at 74303 (emphasis added).

III. THE DEIS FAILS TO PUT THE CONSEQUENCES OF THE PROPOSED ALTERNATIVES SHARPLY INTO FOCUS

In our July 2010 Comment Letter, we noted that any environmental impact statement limited to presenting a cumulative analysis resulting in temperature increase of 1.4ºC over 1990 levels (or an increase of 2ºC over pre-industrial levels), corresponding to a CO_2 stabilization level of approximately 450 ppm, will create a fifty/fifty chance that severe and irreversible impacts from global warming will occur.[72] Levels of 678 ppm predicted under the HD Vehicle DEIS (most likely to correspond to ~3ºC of warming above pre-industrial levels) would cause environmental catastrophes under any scenario. A CO_2 level of 678 would result in a mean global temperature rise of 2.56°C by 2100 according to the DEIS,[73] presumably in relation to 1980-1999 levels, which corresponds to a 3.06°C temperature rise relative to pre-industrial (1850-1899) levels.[74] In addition, as noted in the DEIS, the 2.56°C temperature rise does not include the full temperature impact of 678 ppm due to time lags in the warming commitment, and thus the full temperature response from 678 ppm will be higher.[75] NEPA and its implementing regulations direct federal agencies to "[u]se the NEPA process to identify and assess the reasonable alternatives to proposed actions that *will avoid or minimize adverse effects of these actions upon the quality of the human environment*,", and "[u]se all practicable means . . . to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment." 40 C.F.R. § 1500.2(e) and (f) (emphasis added). Thus, an environmental impact assessment that presents as the "most stringent" alternative an action that results in an outcome unsustainable for life as we know it fails its purpose.[76]

As we have previously stated, we ask that NHTSA also present an alternative analysis that shows what must be done to reduce greenhouse gas emissions from HD vehicles so their reduction *proportionally* contributes to reaching sustainable emissions targets (including reaching, by 2020, 17% reductions below 2005 levels, and 25-45% reductions below 1990 levels).[77] Although climate change is a global problem, proportional reductions required by each

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[72] Joel B. Smith et al., *Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) "Reasons for Concern,"* PROC. OF THE NAT'L ACAD, SCL (Feb. 26, 2009) at 1, 5, *available at* http://www.pnas.org/content/early/2009/02/25/0812355106.abstract; IPPC WGII, 2007, *Climate Change 2007 – Impacts, Adaptation and Vulnerability Contribution of Working Group II to the Fourth Assessment Report of the IPCC*, at 11.

[73] DEIS at 4-68.

[74] IPCC Fourth Assessment Report (AR4), *supra* at 45, Table 3.1.

[75] DEIS at 4-68 n.25.

[76] Because no other alternative is presented, the DEIS creates the incorrect impression that the environmental outcome would not change regardless of what course of action the agencies pursued. When the difference in the effects of all alternatives presented amounts to single digits in parts per million of CO_2 concentrations or fractions of a single digit in temperature and sea level rise, it appears that efforts to improve fuel efficiency are futile. Such reasoning, when not accompanied by the proportional-reductions analysis we believe is required, can bolster the misconception that programs to curb greenhouse gas pollution accomplish nothing and are never worth the price, whatever it may be. This line of reasoning was condemned by the Supreme Court in *Massachusetts v. EPA*, when it took EPA to task for characterizing achievable greenhouse gas reduction measures as insignificant. *Massachusetts v. EPA*, 549 U.S. 497, 523-26 (2007).

[77] We thank the Agencies for including in this DEIS information and a graphic description of how its proposed action compares to President Obama's stated goal to reduce U.S. emissions by 17% over 2005 levels by 2020. The public and decision-makers can now clearly appreciate that even the most stringent proposed alternative not only

country, and in turn from each emission source, can be calculated that together would reach sustainable global emission levels.[78] Even if the Agencies conclude that these goals cannot be reached by means of the tools available to them (including the full panoply of technology-forcing options that can feasibly be deployed during the rulemaking period), the presentation of that information, including the costs of implementation and the benefits both obtained and foregone, is the essential function of an adequate NEPA analysis.

We also note that the assumptions underlying the cumulative effects analysis contain a number of flaws. NEPA and CEQ regulations implementing the procedural provisions of NEPA define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions."[79] However, the DEIS uses the Energy Information Administration's Annual Energy Outlook 2010 ("EIA 2010") Reference Case forecast of increase in average fuel efficiency to project future cumulative fuel efficiency gains.[80] This reference case measures improvements anticipated solely from voluntary actions taken by producers, purchasers, and operators of these vehicles, and thus anticipates *no* improvements through regulatory action through 2035 (including the instant proposed regulation).[81] The EIA 2010 Reference Case, therefore, is a classic definition of "business as usual." Moreover, because the EIA 2010 Reference Case projections run only through 2035, "no further increases in fuel efficiency are assumed to occur after 2035 [through 2100] for each regulatory class."[82] Such a scenario is entirely implausible, rather than foreseeable, and thus seriously flawed. While the Agencies must be cautious not to err in the other direction, with overly optimistic assumptions, the overly pessimistic assumptions of the EIA contribute to the (mis-)impression left by the DEIS that the climate problem is insolvable.

We appreciate the Agencies' citations to several emission reduction efforts currently underway by third parties, such as the Regional Greenhouse Gas Initiative and the Western Climate Initiative, as well as similar global initiatives and laws.[83] As the Agencies note, these actions – contrary to the proposed HD Vehicle rule – actually seek *to reduce* total greenhouse gas emissions. Thus, neither the EIA 2010 Reference Case nor the GCAM6.0 scenario (which also suffers from additional inconsistencies pointed out by the Agencies), is "harmonious with

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fails to contribute to reaching this goal, but actually makes its accomplishment much more difficult because HD Vehicle greenhouse gas emissions are allowed to *increase* to between 8.2% and 13.6 percent *above* 2005 levels by 2020.

[78] It is true, as the Agencies assert, that President Obama's directive did not require every emitting sector to contribute equally proportional emission reductions. *See* DEIS, 3-102. The fact that the Agencies may determine that this outcome cannot be attained does not affect the Agencies' duty under NEPA to disclose and analyze the effort that would be required to reach the goal.

[79] *See* 40 CFR 1508.7.

[80] DEIS at 4-1.

[81] *Id.*

[82] *Id.* at 4-5.

[83] *Id.* at 4-51 through 4-55. To these examples the Agencies should add the recently announced "Massachusetts Clean Energy and Climate Plan for 2020," which aims to reduce emissions to 25 percent below their 1990 levels by 2020. MASSACHUSETTS CLEAN ENERGY AND CLIMATE PLAN FOR 2020 (WINTER 20201, *available at* *http://www.mass.gov/?pageID=eoeeaterminal&L=3&L0=Home&L1=Air,+Water+%26+Climate+Change&L2=Climate+Change&sid=Eoeea&b=terminalcontent&f=eea_energy_2020-clean-energy-plan&csid=Eoeea*.

implementation of these policies and initiatives."[84] Thus, the cumulative impacts analysis remains improperly skewed to forecasting much smaller global CO_2 emission reduction gains than are reasonably foreseeable. These errors exacerbate the false impression that emission reductions achieved by the HD Vehicle Rule have negligible effects.

IV. THE DEIS IMPROPERLY FAILS TO DISCUSS ALTERNATIVES THAT REDUCE BLACK CARBON EMISSIONS FROM HD VEHICLES

Even though HD Vehicles are a significant source of black carbon emissions,[85] the DEIS fails to discuss any alternative that reduces these emissions. Black carbon is both a component of $PM_{2.5}$ and an extremely effective climate warming agent, and while not yet officially declared an air pollutant in its individual capacity by EPA, it certainly meets that definition. Moreover, its deleterious health effects are unquestionable. For all of these reasons, the DEIS should take black carbon emission reductions into account in presenting and discussing alternative emission reduction measures. Further, the DEIS' discussion of black carbon includes a number of scientific errors. We request that the FEIS discuss alternatives that reduce black carbon emissions from HD Vehicles and correct the errors noted.

The DEIS' discussion of the net radiative forcing of black carbon creates the misleading impression that there are instances in which black carbon can exert a cooling influence on the atmosphere. This is untrue. The DEIS cites Ramanathan and Carmichael as demonstrating that, when solar radiation is absorbed by black carbon, some of the radiation will not reach the surface, causing "dimming." While this is true, the enhanced atmospheric warming due to black carbon will always be greater than any dimming and global mean radiative forcing increases regardless of changes at the Earth's surface.[86] In fact, Ramanathan and Carmichael specifically indicate that it is *not* appropriate to compare surface dimming with GHG forcings because the net atmospheric forcing of black carbon is still positive.[87]

The DEIS also states that the impact of black carbon cannot be compared to that of other greenhouse gases. This statement is misleading. Typically, a global warming potential (GWP) is derived for a given greenhouse gas, which is multiplied by the volume emitted to allow a comparison between the strength of warming caused by different greenhouse gases. While is it true that no single value has emerged for the global warming potential (GWP) of black carbon, all estimates indicate that it is extremely powerful, especially over short time spans. Bond and Sun estimate the GWP of black carbon relative to CO_2 to be 680 for a 100 year period.[88] Reddy and Boucher estimate the GWP of black carbon at 480 for a hundred year period, with a range of 374 to 677, depending on the different atmospheric residence time and amount of insolation.[89] Jacobson estimates the GWP for black carbon at significantly higher levels – 1500-2400 for

[84] DEIS at 4-55.
[85] HD Vehicles in the U.S. contribute just over 3 percent of global black carbon emissions. DEIS at 3-79.
[86] V. Ramanathan and G. Carmichael, *Global and Regional Climate Changes Due to Black Carbon*, 1 NATURE GEOSCIENCE 221, 223, Figure 2 (2008).
[87] *Id*.
[88] T. Bond and H. Sun, *Can Reducing Black Carbon Emissions Counteract Global Warming*, 39 ENVIRONMENTAL SCIENCE & TECHNOLOGY 5291 (2005).
[89] M.S. Reddy and O. Boucher, *Climate impact of black carbon emitted from energy consumption in the world's regions*, 34 GEOPHYSICAL RESEARCH LETTERS L11802 (2007).

black carbon and 840-1280 for fossil fuel soot.[90] Although these values vary depending on the assumptions involved, the message is clear: black carbon is an extremely effective climate warming agent when compared to carbon dioxide and methane. The Agencies do not require an exact value for comparing black carbon's deleterious effect to that of other greenhouse gases to know that black carbon must be reduced. The key information is unquestionable: black carbon is emitted in large quantities by diesel engines, black carbon is an extremely potent warming agent, and technologically feasible, appropriate and cost-effective measures exist to reduce these emissions.

The DEIS black carbon discussion also appears at times to conflate aerosols and black carbon. For instance, it states that "the magnitude of aerosol effects can vary immensely with location and season of emissions."[91] Similarly, the DEIS discusses "atmospheric brown clouds" or "ABCs." ABCs, however, are the result of combined aerosols emitted in various regions, and include black carbon as well as other lighter-colored aerosols.[92] The analysis of such other aerosols is not relevant to the analysis of the specific impacts of black carbon. Black carbon is the only aerosol that consistently leads to atmospheric heating, whereas other aerosols may have cooling or mixed effects. These errors must be corrected so that the DEIS reflects only data related specifically to black carbon.

The difference in the impact of black carbon compared with other aerosols makes the immediate reduction of black carbon crucial. It is estimated that greenhouse gas pollution has contributed about 3 W/m^2 of heating to the atmosphere since the Industrial Revolution.[93] Yet, observed warming has been only about 30% of what would be expected for this amount of radiant energy.[94] It is believed that while some energy has been stored in the oceans, about 50% of the energy is "masked" by the cooling effect of *non*-black carbon aerosols. Because these other aerosols are a public health hazard, they are in decline and will continue to decline. This means that atmospheric heating will increase substantially. One way to combat this "unmasking" is to reduce black carbon.[95] Ramanathan and Xu estimate that black carbon has contributed about 0.9 W/m^2 of warming since the Industrial Revolution.[96] Thus, significant reductions in black carbon could also substantially reduce the consequences of aerosol "unmasking."

The DEIS appears to assume that the existence of regulations reducing $PM_{2.5}$ relieve the Agencies of their duty to address black carbon in the DEIS and proposed rulemaking. This is incorrect. Because particulate matter is composed of multiple aerosol compounds, the overall PM level from a given source can be reduced by decreasing any one or more of its constituent pollutants – without, however, necessarily reducing the black carbon component in equal

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[90] *EPA Black Carbon and Global Warming: Hearing Before the H. Comm. on Oversight and Gov't. Reform*, 110th Cong. 12-29 (2007) (statement of Mark Z. Jacobson, Professor, Stanford University).
[91] DEIS at 3-77.
[92] V. Ramanathan and Y. Feng, *On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead*, 105 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 14245, 14246 (2008).
[93] V. Ramanathan and Y. Xu, *The Copenhagen Accord for limiting global warming: Criteria, Constraints, and Available Avenues*, 107 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 8055, 8056 (2010).
[94] *Id.*
[95] *Id*. at 8058.
[96] *Id.*

proportion. For example, diesel oxidation catalysts can reduce diesel PM emission as a whole by approximately 20 to 40%, yet they do not decrease the carbonaceous component of the PM.[97] While black carbon is the predominant component of diesel PM, sulfates are the other major contributor. Measures that aim to reduce sulfates, such as low-sulfur diesel fuel, may reduce PM levels, but do not necessarily maximize black carbon reductions, leading some industry experts to recognize that low sulfur fuels may be necessary, but not sufficient to achieve black carbon reductions.[98] Low sulfur fuel is important because it *allows* for better technology to reduce black carbon, such as the use of diesel particulate filters (DPFs).[99] However, desulphurization of fuels does not guarantee the significant cuts in black carbon that climate scientists recommend.

Although MAGICC, the model the Agencies use to simulate climate effects, does not include a user-manipulated black carbon variable at this time, black carbon is included in the basic model. If MAGICC is deemed insufficient for the task, the Agencies can obtain other models that estimate the climate effects of black carbon. An example of the use of such a model is contained in Ramanathan and Xu.[100] Even if no currently available model can estimate the exact magnitude of black carbon's climate effect, however, enough scientific data exists for the Agencies to determine that black carbon must be addressed aggressively to reduce the damages caused by global warming.

Even though black carbon is a significant factor in current atmospheric warming, the proposed HD Vehicle Rule takes no steps to address those effects. By comparison, the proposed rulemaking would apply a "cap" on emissions of two non-CO_2 greenhouse gases, methane (CH_4) and nitrous oxide (N_2O)[101] to counteract potential increases in these greenhouse gases as a byproduct of fuel efficiency improvements. Notably, under a number of the alternatives presented in the DEIS, including the preferred alternative, black carbon is predicted to increase with attempts to improve fuel efficiency.[102] This increase in black carbon emissions would counteract the greenhouse gas emission reductions sought by the proposed rule. For these reasons, the DEIS should, at a minimum, include discussion of a "cap" on black carbon to prevent increased emissions from any of the alternatives, and should take black carbon emission reductions into account in presenting and discussing alternative emission reduction measures.

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[97] A.P. Walker, *Controlling Particulate Emissions from Diesel Vehicles*, 28 TOPICS IN CATALYSIS 1-4, AT 165, 166 (Apr. 2004)

[98] Dante Bonaquist & Riva Krut, The Role of Hydrogen in Minimizing Black Carbon Emissions from Diesel Engines: A White Paper, Praxair (May 2010), *available at*: www.google.com/url?q=http://www.praxair.com/praxair.nsf/0/6D73B5DA741457DA8525772900703E30/%24file/Praxair-H2MinimizingBlackCarbonEmissions-WhitePaper.pdf&sa=X&ei=KpFHTOOHLoXfnAen4b3QBA&ved=0CBUQzgQoADAA&usg=AFQjCNG0X8ZW5l-DtwXG3Z6Iy6ttW8iLhw.

[99] *See, e.g.*, 69 Fed. Reg. 38957, 38995 (Jun. 29, 2004)

[100] Ramanathan and Xu, (citing F. Joos et al., *An efficient and accurate representation of complex oceanic and biospheric models of anthropogenic carbon uptake*, 48 TELLUS SERIES B: CHEMICAL AND PHYSICAL METEOROLOGY 397 (1996)).

[101] NPRM, 75 Fed. Reg. 74207.

[102] *See, e.g.*, DEIS at Table 3.3.3-1, Table 3.3.3-5 ($PM_{2.5}$ and Diesel Particulate Matter, respectively).

V. OTHER ISSUES

(a) Recent Scientific Evidence Demonstrates that Risks from Climate Change Are Substantially Greater Than Assessed in the 2007 IPPC Fourth Assessment Report

With our July 10, 2010 Comment Letter, we submitted substantial scientific material demonstrating that the assumptions underlying the 2007 IPPC Fourth Assessment Report must be updated because the risks from climate change are substantially greater than there assumed. We ask the Agencies to take this updated information, as well as the additional scientific literature cited herein, into account in arriving at their decisions.

(b) The HD Vehicle Rulemaking Should Commence with Model Year 2015

As we stated in the July 2010 Comment Letter, in light of the urgency of taking action to avoid the worst results of climate change, the standards should go into effect as soon as the law allows, *i.e.*, *four* years after finalization of the proposed rule in 2011 (thus, beginning with model year 2015).[103] Further, the Agencies' laudable plan to develop an optional voluntary compliance standard before mandatory standards take effect should begin with model year 2011-2014, not model year 2014-2015.

(c) The Agencies Should Not Offset Fuel Savings Based on the Rebound Effect

The Agencies admit that in the case of HD Vehicles, the rebound effect has not been studied extensively, and that the National Academy of Sciences has determined that it is "'not possible to calculate with a great deal of confidence what the magnitude of the 'rebound' effect is for heavy-duty trucks.'"[104] At least until the Agencies can estimate the rebound effect on HD Vehicle drivers – if any – with some confidence, the fuel savings of the proposed rulemaking should not be discounted.

VI. CONCLUSION

We appreciate the opportunity to submit these additional comment and thank you for your consideration.

[103] *See* 49 U.S.C. § 32902(k)(3) ("[t]he [HD vehicle] fuel economy standard . . . shall provide not less than . . . four model years of regulatory lead-time").
[104] DEIS at 3-6.

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ATTACHMENT D

Comments by Center re: Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Proposed Rule; Docket Nos. NHTSA-2010-0079 and EPA-HQ-OAR-2010-0162
(January 31, 2011)

CENTER *for* BIOLOGICAL DIVERSITY

VIA UPLOAD TO DOCKET NO. NHTSA-2010-0079 at REGULATIONS.GOV

January 31, 2011

National Highway Traffic Safety Administration
Docket Management Facility, M-30
U.S. Department of Transportation, West Building
Ground Floor, Rm. W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590
Attn: NHTSA-2010-0079

Air Docket
Environmental Protection Agency
EPA Docket Center, Mailcode: 6102T
1200 Pennsylvania Ave., N.W.
Washington, DC 20460
Attn: EPA-HQ-OAR-2010-0162

Re: Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Proposed Rule; Docket Nos. NHTSA-2010-0079 and EPA-HQ-OAR-2010-0162

The Center for Biological Diversity (the "Center") hereby submits the following comments to the Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Proposed Rule; Docket Nos. NHTSA-2010-0079 and EPA-HQ-OAR-2010-0162 (the "Proposed Rule"). On January 3, 2011, we submitted comments to the Draft Environmental Impact Statement, Medium- and Heavy-Duty Fuel Efficiency Improvement Program (October 2010) ("DEIS") that accompanies the Proposed Rule (the "January 3, 2011 Comment Letter"), and on July 14, 2010, we submitted comments to the Notice of Intent to Prepare an Environmental Impact Statement for New Medium- and Heavy-Duty Fuel Efficiency Improvement Program (75 Fed. Reg. 33565) (the July 2010 Comment Letter); we attach these comment letters hereto and incorporate them and their attachments by reference as if fully set forth herein.

The Center is a non-profit environmental organization dedicated to the protection of imperiled species, their habitats, and the environment through science, policy, and environmental law. The Center has over 320,000 members and online activists throughout the United States.

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These comments are filed on behalf of our members and staff with a vital interest in reducing greenhouse gas and other air pollutants.

We fully support NHTSA's and EPA's (the "Agencies") efforts to curb greenhouse gas emissions from and improve the fuel efficiency of new medium- and heavy-duty on-highway vehicles and work trucks and their engines ("HD Vehicles"), and appreciate the opportunity to submit comments on the Proposed Rule. We thank the Agencies for taking our comments, including those to the recent light-duty vehicle rules, into account. The Proposed Rule, however, contains significant flaws and fails to set the HD Vehicle standards at the maximum feasible level. We have discussed many of these issues in detail in our prior comment letters, and here will raise only additional concerns while seeking to avoid repetition.

I. THE PROPOSED RULE FAILS TO PRESENT AN ALTERNATIVE THAT REPRESENTS THE MAXIMUM FEASIBLE FUEL EFFICIENCY IMPROVEMENTS

The applicable statutes require that the Proposed Rule[1] implement fuel efficiency standards that achieve *the maximum feasible improvement* in HD Vehicle fuel efficiency. The Proposed Rule fails to fulfill this mandate.

(a) The Applicable Standards

The purposes of the Energy Policy Conversation Act ("EPCA") are to decrease the nation's dependence on foreign imports, to enhance national security and to achieve the efficient utilization of scarce resources.[2] To achieve these goals, EPCA, as amended by the Energy Independence and Security Act of 2007 ("EISA"), expressly demands that NHTSA set *maximum feasible* fuel economy standards.[3] In the case of HD Vehicles, Section 32902(k) of EPCA requires NHTSA to set standards and implement a HD Vehicle "fuel efficiency improvement program *designed to achieve the maximum feasible improvement*."[4] The requisite standards shall be "appropriate, cost-effective, and technologically feasible for commercial medium-and heavy-duty on-highway vehicles and work trucks."[5] In fulfilling its duties under Section 32902(a), NHTSA "cannot set fuel economy standards that are contrary to Congress's purpose in enacting the EPCA – energy conservation," it cannot act arbitrarily and capriciously; it cannot advance conclusions unsupported by the evidence; if it conducts cost-benefit analyses, it may not assign values of zero to benefits that can be ascertained within a range; and it cannot bias its cost-benefit analysis.[6] Section 32902(k) imposes the same requirements. In addition, fuel efficiency standards under EPCA and EISA must be technology-forcing.[7]

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[1] Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles; Proposed Rule, 75 Fed. Reg. 74152 (Nov. 30, 2010) (the "Proposed Rule").
[2] *Center for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1182 (9th Cir. 2007).
[3] 49 U.S.C. § 32902(a).
[4] 49 U.S.C. § 32902(k)(2) (emphasis added).
[5] *Id.*
[6] *Center for Biological Diversity v. NHTSA, supra*, 538 F.3d at 1197, 1200, and *passim*.
[7] EPCA and EISA are meant to encourage technological innovation in the field, not simply promote the wider adoption of existing technologies. *See, e.g., Center for Auto Safety v. Thomas*, 847 F.2d 843, 870 (D.C. Cir. 1988) (overruled on other grounds) ("[t]he experience of a decade leaves little doubt that the congressional scheme in fact

EPA's authority to regulate greenhouse gas emissions from HD Vehicles is codified in section 202(a) of the Clean Air Act ("CAA").[8] The Act's pollution emission reduction goals are technology-forcing:

> Case and statutory law support the broad authority of EPA to force substantial change on the status quo on an industry-wide basis. The "technology-forcing goals" of Subchapter 11, the portion of the Clean Air Act that establishes emissions standards for moving vehicles, are well recognized. *See Whitman v. American Trucking Ass'ns*, 531 U.S. 457, 491-492, 121 S. Ct. 903, 149 L. Ed. 2d 1 (2001) (Breyer, J. dissenting). The technology-forcing authority of the Clean Air Act is embodied in the language of the Act that directs EPA to promulgate standards "that reflect the greatest degree of emission reduction achievable through the application of technology which the Administrator determines will be available for the model year to which the standards apply, ..." 42 U.S.C. § 7521(a)(3)(A)(i). EPA is thus empowered to set standards for future model years based on reasonable projections of technology that may not be available currently. *NRDC v. Thomas*, 256 U.S. App. D.C. 310, 805 F.2d 410, 429 (D.C. Cir. 1986).

Cent. Valley Chrysler-Jeep, Inc. v. Goldstene, 529 F. Supp. 2d 1151, 1178 (E.D. Cal. 2007); *see also Motor Vehicle Mfrs. Ass'n v. New York State DEC*, 17 F.3d 521, 536 (2nd Cir. 1994) (noting that the Clean Air Act is "technology forcing" in the context of California's LEV program).

The Proposed Rule fails to achieve the statutory mandates of setting maximum feasible fuel efficiency improvements, and of forcing technological innovation, by purposefully limiting itself to the application of technology that is already commercially available today, by setting standards that at lax enough to permit manufacturers to exclude even some of this available technology, and by failing to present an alternative that truly presents the "maximum feasible" emission reductions. The Agencies should revise the Proposed Rule and adopt standards that meet their statutory obligations.

(b) Technologies Exist or Can Be Implemented During the Rulemaking Period That Improve Fuel Efficiency Gains By Up To 50%

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induced manufacturers to achieve major technological breakthroughs as they advanced towards the mandated goal"); *Green Mt. Chrysler Plymouth Dodge Jeep v. Crombie*, 508 F. Supp. 2d 295, 358-359 (D. Vt. 2007) (discussing technology-forcing character of EPCA and the use of increased fuel efficiency to augment performance rather than mileage): *Kennecott Greens Creek Min. Co. v. Mine Safety and Health Admin.*, 476 F.3d 946, 957 (D.C. Cir. 2007) ("when a statute is technology forcing, the agency can impose a standard which only the most technologically advanced plants in an industry have been able to achieve – even if only in some of their operations some of the time"). The Clean Air Act is similarly technology-forcing. Legislative history indicates that the primary purpose of the Act was not "to be limited by what is or appears to be technologically or economically feasible," which may mean that "industries will be asked to do what seems impossible at the present time." 116 Cong. Rec. 32901-32902 (1970), Legislative History of the Clean Air Amendments of 1970 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-18, p. 227 (1974); *see also Whitman v. American Trucking Association*, 531 U.S. 457, 491 (2001).

[8] 49 U.S.C. § 7521(a)(3)(A)(i).

In our January 3, 2011 Comment Letter, we discussed technologies that either exist or can feasibly be developed and implemented during the rulemaking period, that are appropriate for HD Vehicles, and that can sharply increase their fuel efficiency gains, but that the Agencies have excluded from their preferred choice (Alternative 6). Specifically, we urged the Agencies to impose fuel efficiency regulations on trailers used with Class 7 and Class 8 tractors, to require the use of bottoming cycle technology within the rulemaking years, and to adopt other viable fuel efficiency improvements. We here add the following comments.

In several instances, the Agencies present a "suite" of presently available and feasible technologies, but expressly do *not* require that each technology within the "suite" be applied. For example, in discussing the use of idle reduction technologies, the Agencies state that, "as with all technology inputs discussed in this section, the agencies are not mandating the use of idle reductions or idle shutdown, but rather allowing their use as one part of a suite of technologies feasible for reducing fuel consumption and meeting the proposed standards."[9] In other words, the Agencies allow manufacturers to choose among some proven, available, feasible and efficiency improvements measures, leaving some of them unused (or used only to obtain voluntary credits). However, in every instance where such "optional" technologies would add to a vehicle's fuel efficiency, the failure to require their implementation violates the mandates of EPCA and EISA to produce the "maximum feasible" fuel efficiency improvements. We urge the Agencies instead to adopt efficiency standards that incorporate the use of every one of the technologies now allocated to an optional technology "suite", excepting only those that create no additionality.

The Agencies' failure to drive toward maximum feasible results, and its substitution of inappropriate, non-statutory goals to lead its decision-making is apparent in many instances. For example, they state that "[b]y *focusing on existing technologies and well-developed regulatory tools*, the agencies are able to propose rules that we believe *will produce real and important reductions in GHG emissions and fuel consumption within only a few years.*"[10] Constructing standards based on existing and well-developed technologies takes no account of the technology-forcing mandate of EPCA, EISA and the CAA. The relevant statutes do not call for fuel efficiency improvements that are "real and important," but for *maximum feasible* improvements.[11]

In the case of vocational vehicles in particular, the Agencies have gravely shortchanged the process. They limit performance improvements to just two types of technologies – tire resistance and engine technologies – but leave out entire categories ("[a]erodynamics technology, weight reduction, drive train improvement, and hybrid powertrains"[12]) because grappling with setting standards based on these technologies would be "difficult." [13] While it is true that the number of different types of vocational vehicles and their manufacturers increase the complexity of this vehicle segment, these circumstances do not excuse the Agencies from requiring the use

[9] Proposed Rule, 75 Fed. Reg. 75185.
[10] *Id.* at 74213 (emphasis added).
[11] *See also id.* at 74213 ("This proposal is based on the need to obtain *significant* oil savings and GHG emissions reductions from the transportation sector, and the recognition that there are appropriate and cost-effective technologies to achieve such reductions feasibly") (emphasis added); and *passim.*
[12] *Id.* at 74244.
[13] *Id.* at 74241.

of available, feasible, and cost-effective technologies. Aerodynamics, regenerative breaking/acceleration, idling reduction, hybrid powertrains and the use of advanced materials to reduce weight could achieve tremendous additional improvements – between 20 to 50 percent fuel use reductions in the case of hybrid powertrains alone.[14] As to hybrid powertrains, the Agencies state that their decision to exclude them as a mandatory measure – even though hybrid powertrains are *already in use* – is motivated by a desire not to "overestimate" the number of hybrids that are likely to be introduced into the market; instead, they propose to encourage production of hybrids through credits alone.[15] This approach completely misperceives the Agencies' mandate: rather than applying a conservative approach, the Agencies must push for technological breakthroughs through the use of ambitious goals.[16] The Agencies cannot simply exclude a presently available technology that delivers considerable fuel efficiency improvements because they cannot precisely estimate future market penetration or fear potentially slower uptakes. The law requires exactly the opposite approach.[17]

(c) The Agencies' Phase-In Schedules Are Overly Long, Thereby Failing to Achieve Maximum Feasible Results

Throughout the rulemaking, the Agencies propose to delay implementation of certain technologies until the last year of the rulemaking period, or take them off the table entirely because of concerns that there is insufficient lead time to implement them at all.[18] As set forth above, these delays violate the technology-forcing mandates of the statutes. However, they also ignore the fact that a full six years will pass between the finalization of the Proposed Rule in 2011 and the last rulemaking year, which begins in 2017. Structuring a fuel efficiency improvement rulemaking based on the assumption that HD Vehicle manufacturers cannot accomplish even modest progress during a six year period simply fosters the continuing decline in American competitiveness.[19]

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[14] *Id.* at 74242.

[15] *Id. See* discussion of credits below.

[16] *See* cases and legislative history cited in footnote 7, *supra*.

[17] The Agencies estimate that a 25 percent utilization rate of hybrid powertrains in MY 2017 vocational vehicles might increase the cost per vehicle by $30,000. Proposed Rule, 75 Fed. Reg. 74245. Even if this estimate were correct, it alone cannot justify dismissing these improvements absent a full cost-benefit analysis, which the Agencies have not provided. As to weight reduction efforts, the Agencies have simply skipped the economic analysis of the costs and benefits to be achieved. *Id.* at 74241.

[18] The need to reduce greenhouse gases sooner rather than later could not be more clear and urgent, as the world's ability to cap emissions to keep temperature rises even at 2ºC above pre-industrial levels are fading fast. As the chief economist for the International Energy Agency stated recently, "As we stand now, we're only a few meters away from saying goodbye to the 2-degree target." *Scenario to Cap World Emissions by 2020 is Fading Fast, Warns IEA Economist*, CLIMATE WIRE , Jan. 14, 2011, *available at* http://www.eenews.net/climatewire/2011/01/24/archive/1?terms=Fatih+Birol.

[19] Ambitious health and safety regulations which require more U.S. manufacturers to meet somewhat more stringent standards than those in place in other countries create a competitive advantage for U.S. industry by continually spurring the innovation that is so critical to success in today's global economy. Porter, M. and Claas van der Linde, *Toward a New Conception of the Environment-Competitiveness Relationship*, 9 Journal of Economic Perspectives 97, 97-118 (1995), *available at www.greengrowth.org/download/green...pub/.../Porter.pdf*. Furthermore, while it is often wrongly asserted that more ambitious health and safety rules will create a competitive disadvantage for U.S. industry, no such substantial impact has been demonstrated. EPA, *Clean Air Act, and U.S. Manufacturing*, WORLD RESOURCES INSTITUTE, November, 2010 ("WRI 2010(a)"), *available at www.wri.org/stories/2010/.../epa-clean-air-*

That precisely the opposite is true – i.e., that vehicle manufacturers can and will successfully adjust to rulemakings requiring much more rapid progress – is proven by the fact that heavy-duty engine manufacturers have *already* changed their entire redesign cycles to adjust to EPA's criteria pollutant program for these engines. As the Agencies state:

> *Recently, EPA's heavy-duty highway engine program for criteria pollutants provided new emissions standards for the industry in three year increments. Largely, the heavy-duty engine and truck manufacturer product plans have fallen into three years cycles to reflect this regulatory environment.*[20]

In light of the Agencies' insistence over many years of corporate average fuel efficiency rulemaking that fuel efficiency improvements are axiomatically constrained by sacrosanct five-year industry vehicle redesign cycles, this admission is stunning. As the Center has repeatedly pointed out, unquestioning deference to these artificial constraints without analysis of the costs and benefits flowing from their alteration violates the Agencies' statutory obligation. Plainly, technology-forcing rulemakings can and do succeed, change industry performance and result in more advanced, fuel efficient products in a cost-efficient manner, whereas regulations designed to accommodate business-as-usual simply perpetuate business-as-usual.

In the case of HD Vehicle engines, the Agencies further admit that during the period from 2014-2017, "engine manufacturers are expected to redesign and upgrade their products. Over these four model years there will be an opportunity for manufacturers to evaluate almost every one of their engine models and add technology in a cost-effective way, consistent with existing redesign schedules, to control GHG emissions ad reduce fuel consumption." [21] Thus, for example, no perceived redesign cycle constraints stand in the way of the adoption of bottoming cycle technology during the rulemaking period. As pointed out in our January 3, 2011 Comment Letter, this technology is especially promising and should and can be implemented.

Another example of unsupported implementation delay is the proposed schedule for tire improvements for vocational vehicles. The six-year incremental phase-in schedule is not justified by a full analysis, leaving unexplained why presently available tire improvements cannot be presently implemented.[22] We urge the Agencies to address this shortcoming.

As to tractors, the Agencies have based their standards on the assumption that only 20 percent of aerodynamic improvements available through Advanced SmartWay technologies should be required through the end of the rulemaking period because of the "limited lead time for the program and the need for these more advanced technologies to be developed and demonstrated before being applied across a wider fraction of the fleet."[23] As discussed above, this approach is indefensible in light of the fact that these technologies do exist or have

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act-and-us-manufacturing; Goodstein, E., et al., *Climate Policy and Jobs: An Update on What Economists Know*, ECONOMICS FOR EQUITY AND THE ENVIRONMENT NETWORK (2010).

[20] Proposed Rule, 75 Fed. Reg. 74177 (emphasis added).
[21] *Id.* at 74177.
[22] *Id.* at 74241.
[23] *Id.* at 74222.

progressed far in the developmental stage, that a lead time of six years for full deployment is more than ample, and that Congress intended the Agencies to ask industry to do even "what seems impossible at the present time."[24]

Similarly, in the case of heavy-duty pickup trucks and vans, the Agencies' undue deference to business-as-usual leads to an unacceptably slow phase-in of presently available technology. By design, the Agencies create opportunities for the three large manufacturers that together produce 95% of these vehicles to delay bringing all of their newly produced vehicles to higher standards in 2014 by allowing large portions of the fleet to remain unimproved. For example, under one contemplated approach, the Agencies propose to set a final standard for heavy-duty pickup trucks and vans in 2014, but to permit manufacturers to limit the percentage of vehicles in each model year that comply with the standard:

> The percentage of regulated vehicles would increase each year, to 100 percent in 2018. We think it likely that manufacturers would *leave the highest emitting vehicles unregulated for as long as possible* under this approach, because these vehicles would tend to be the costliest to redesign or may simply be phased out of production.[25]

In other words, this proposal acknowledges that *all* of the improvements underlying the standard are available and can be used in newly built vehicles as early as 2014, yet intentionally delays fleet-wide implementation for years. By definition, then, these technologies are both appropriate and technologically feasible. Therefore, the only factor that could justify delayed implementation across the entire fleet is cost-effectiveness. [26] Crucially, however, the Agencies have failed to state the cost of fleet-wide implementation by 2014, thus depriving the public and decision-makers of necessary information. But regardless of that calculation, because the benefits of the rulemaking outweigh its costs by orders of magnitude, there is no doubt that this delay cannot be rationalized based on cost concerns alone. The implementation schedule approach abandons the concept of maximum feasible improvements, improperly weighs the requisite statutory factors, and/or impermissibly introduces extraneous considerations that arbitrarily weaken the resulting rulemaking.

A similarly arbitrary approach is proposed for the worst-polluting engines within the HD Vehicle class. The Agencies have identified a "group of legacy engines" with emissions higher than the industry baseline. Instead of requiring their immediate phase-out or complete redesign, the Agencies propose to allow them a special worst-polluter exemption by adjusting their baseline upwards. This is proposed even though there are no technological obstacles to building HD Vehicles with much higher-performing engines now:

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[24] 116 Cong. Rec. 32901-32902 (1970), Legislative History of the Clean Air Amendments of 1970 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-18, p. 227 (1974).
[25] Proposed Rule, 75 Fed. Reg. 74195(emphasis added). This proposal is especially egregious because, as the Agencies acknowledge, it would promote rather than discourage the early retirement of the most fuel-inefficient vehicle types.
[26] 49 U.S.C. § 32902(k)(2).

> The issue is not whether these engines' GHG and fuel consumption performance cannot be improved by utilizing the technology package on which the proposed standards are based. These technologies can be utilized by all engines and the same degree of reductions obtained. Rather the underlying base engine components of these engines reflect designs that are decades old and therefore have base performance levels below what is typical for the industry as a whole today.[27]

The Agencies claim that to accelerate full replacement of these dirty engines to MY 2014 would be "impossible as a practical matter given the engineering structure and lead-times inherent in the companies' *existing product development process*."[28] Since engines with much better performance already exist, what might require "development" is unclear. But even assuming some need for development, the Agencies also leave unexamined what it would cost to change those "existing" processes. The proposed solution – permitting the dirtiest engines with decades-old designs to be built for many more years – is stated without full analysis of the requisite statutory factors. The Agencies should excise this proposed worst-polluter-protection exception from the final rule.

In our January 3, 2011 Comment Letter, we have already urged the Agencies to set standards based on the use of speed governors, whose potential to limit fuel consumption is highly significant since fuel consumption and CO_2 emissions increase proportional to the square of vehicle speed. Moreover, speed governors are already used in the industry and are inexpensive. The Agencies base their decision not to assume the use of speed governors on their stated concern that they lack jurisdiction to require them; however, we note here that the Agencies already require speed limiters' use where manufacturers seek to qualify their tractors as "off-road" to qualify them for an exemption to the rulemaking.[29] If the Agencies can mandate the use of a technology as a condition to obtaining a statutory exemption, they can adopt standards that are premised on their use as well.

The Agencies have also asked for comment on a proposal to permit the Proposed Rule, once finalized, to stay in effect indefinitely.[30] The Center believes such a decision would constitute a *per se* violation of Section 32902(k). Even though that section does not prescribe the precise dates when the Secretary of Transportation must set new fuel efficiency standards for HD Vehicles, standards that are not continually and regularly updated (while retaining four years of lead time and three years of regulatory stability) by definition cannot achieve maximum feasible, or indeed *any*, fuel efficiency improvements over time. An announcement that no further regulation will be forthcoming would also remove all incentives for future research and development to reduce greenhouse gas emissions and slow HD Vehicles' fuel consumption. This proposal flies in the face of EPCA's, EISA's and the CAA's goals and should be definitively rejected.

(d) The Agencies Fail to Present an Alternative That Represents the Maximum Feasible Emission Reductions and Fuel Consumption Improvement

[27] Proposed Rule, 5 Fed. Reg. 74230.
[28] *Id.* (emphasis added).
[29] *Id.* at 74176.
[30] *Id.* at 74172.

None of the ten alternative stringencies the Agencies present in the Proposed Rule and the accompanying DEIS contains all of the available technologies to reduce fuel consumption and greenhouse gas emissions. Although Alternative No. 8 – presented as the most stringent alternative – adds hybrid powertrain technologies for vocational vehicles and heavy-duty pickups and vans, it excludes, at a minimum, both the use of bottoming cycles for Class 7 and 8 tractors and weight reduction of 10 percent for heavy-duty pickups and vans (technology additions assumed for Alternative 6b).[31] Moreover, the Agencies have not calculated the monetized net benefits associated with either Alternative 6b or Alternative 8.[32] This omission deprives the public and decision-makers of crucial information required to compare and weigh the Agencies' preferred alternative (Alternative 6) against either of these two alternatives, both of which would achieve significantly better greenhouse gas emissions and fuel efficiency. We urge the Agencies to provide complete information and a truly technology-forcing alternative.

We strongly urge the Agencies to adopt an alternative not depicted here: a combination of Alternative 6b with the additional technologies added in Alternative 8 and other technologies discussed here and in our earlier comment letters but which have been rejected by the Agencies. A full cost-benefit analysis which does not improperly put the thumb on one side of the scale will undoubtedly prove that alternative to remain highly cost-effective.

II. THE PROPOSED RULE UNDERSTATES THE ENVIRONMENTAL BENEFITS OF GREENHOUSE GAS REDUCTIONS AND FUEL EFFICIENCY IMPROVEMENTS, OVERSTATES THE COSTS, AND FAILS TO PUT THE CONSEQUENCES OF THE PROPOSED ALTERNATIVES INTO SHARP FOCUS

We have provided extensive comments on the shortcomings of the Agencies' cost-benefit analysis in our prior comment letters, including the understatement of the social cost of carbon and the failure to monetize the damages attendant to crossing tipping points and ocean acidification, among other things. We have urged the Agencies to abandon an approach that removes the use of technologies presently available or that can be implemented during the rulemaking years based on cost concerns even though the proposed rulemaking results in *net profits* to the regulated industry (without ever taking the social cost of carbon into consideration at all).[33] We have also described the Agencies' failure to provide the public and decision-makers with truly relevant comparisons that put the consequences of the proposed alternatives into sharp focus. We add here that the Agencies themselves acknowledge defects in their analysis when they state that the "monetized benefits of CO_2 reductions . . . represent only a partial accounting of total benefits due to omitted climate change impacts and other factors that are not readily monetized" and omit "other impacts such as benefits related to non-GHG emission reductions."[34]

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[31] *Id.* at 74340. Also excluded, *inter alia*, are the four technology categories rejected for vocational vehicles.
[32] *Id.* at 74344-45 (Tables IX-4 and IX-5).
[33] This Court has previously stated that "[c]ost-benefit analysis means weighing the marginal gain against the marginal cost of each increment of further regulation and then setting the level of regulation at the point at which the latter exceeds the former." *Natural Resources Defense Counsel v. EPA*, 804 F.2d 710, 727 (D.C. Cir. 1986), *reversed on other grounds*, 824 F.2d 1146 (D.C. Cir. 1987). A profit-making regulation certainly does not meet that test.
[34] Proposed Rule, 75 Fed. Reg. 7418.

For example, one such benefit is the reduction of costs required to maintain a U.S. military presence to help secure stable oil supplies.[35] In addition, the Agencies have simply failed to analyze the costs and benefits of the most technologically advanced alternatives, Nos. 6b and 8.[36]

Since the time of our January 3, 2011 Comment Letter, additional studies have been published that add to the overwhelming evidence that climate change is currently underway and that the failure to reduce greenhouse gases will cause catastrophic consequences.[37] We include here studies showing record melts from the Greenland ice sheet in 2010;[38] the bigger-than estimated impact on climate from the melting Arctic;[39] and the higher-than previously-estimated risk of lung damage due to ozone pollution,[40] and ask the Agencies to include them in their analysis of climate change impacts.

In light of the highly significant black carbon emissions from HD Vehicles, we also urged the Agencies in our January 3, 2011 Comment Letter to include these emissions in their environmental impact statement and their decision-making process in selecting appropriate technologies and HD Vehicle standards. The discussion of this subject is equally relevant here.

Moreover, a robust and increasing literature continues to highlight the inherent flaws in cost-benefit analysis as a decision-making tool. The estimated costs of a proposed regulation almost universally far overstate the actual costs, sometimes by an order of magnitude or more, due to a number of well-understood factors.[41] First, the information for the cost side of the equation is largely generated by the regulated industries themselves, which have a clear incentive to overstate the costs and thus avoid regulation they oppose.[42] Second, cost-benefit analysis is premised on the incorrect assumption of a static, rather than dynamic, world. Cost-benefit analysis projects costs based on a snapshot in time, ignoring the fact that the costs will in fact

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[35] *Id.* at 74325.
[36] *Id.* at 74344-345.
[37] We note that unfortunately, the Proposed Rule contains this misleading summary of these dangers: "Setting GHG emissions standards for the heavy-duty sector will help to address climate change, which is widely viewed as a significant long-term threat to the global environment." *Id. at* 74156. The Agencies here seem to overlook EPA's own endangerment finding concerning greenhouse gases and the vast scientific evidence that supports its devastating conclusions. Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66496 (December 15, 2009). These threats posed by climate change are a matter of established fact rather than a matter of opinion. The misleading language cited above should be removed.
[38] M. Tedesco et al., *The Role of Albedo and Accumulation in the 2010 Melting Record in Greenland*, ENVIRONMENTAL RESEARCH LETTERS, Environ. Research Letter 6 (2011), DOI:10.1088/1748-9326/6/1/014005, *available at* http://iopscience.iop.org/1748-9326/6/1/014005.
[39] M.G. Flanner et al, *Radiative Forcing and Albedo Feedback from Northern Hemisphere Cryosphere*, NATURE GEOSCIENCE , Jan. 16, 2011, DOI:10.1038/NGE01062, *available at* http://iopscience.iop.org/1748-9326/6/1/014005.
[40] Chong S. Kim et al., *Lung Function and Inflammatory Responses in Healthy Young Adults Exposed to 0.06 ppm Ozone for 6.6 Hours*, AMERICAN JOURNAL OF RESPIRATORY AND CLINICAL CARE MEDICINE , Jan. 7, 2011, DOI:10.1164/rccm.201011-1813OC, *available* at http://ajrccm.atsjournals.org/cgi/content/abstract/201011-1813OCv1.
[41] *See, e.g., For EPA Regulations, Cost Predictions are Overstated*, WORLD RESOURCES INSTITUTE (November 17, 2010), available at http://www.wri.org/stories/2010/11/epa-regulations-cost-predictions-are-overstated; Ackerman, F., and L. Heinzerling, *Priceless, On Knowing the Price of Everything and the Value of Nothing*, THE NEW PRESS (2004), at 38; Driesen, D.M., *The Economic Dynamics of Environmental Law*, MASSACHUSETTS INSTITUTE OF TECHNOLOGY (2003), at 22-23.
[42] WRI 2010(b), *supra*; Driesen, *supra*.

change over time due to the regulation itself and other factors. Environmental and health protection rules spur innovation and lower the cost of pollution prevention.[43] For these reasons, the use of cost-benefit analysis almost universally biases an agency's decision against a more ambitious pollution reduction rule and is a fundamentally flawed and inappropriate decision-making tool.[44] All of these pitfalls are present in the current rulemaking, in addition to the other problems already discussed. Thus, the Agencies' use of cost-benefit analysis in the proposed rulemaking is not only highly arbitrary but also prevents the accomplishment of the statutory mandate to require the maximum feasible level of fuel economy.

III. THE AGENCIES SHOULD REMOVE MOST CREDITS AND AVERAGING, BANKING AND TRADING

Because it offers manufacturers various credits, averaging, banking and trading, and the option to pay penalties rather than comply with the proposed standards, the resulting rulemaking will likely increase emissions and decrease fuel efficiency of HD Vehicles. This is especially true since the Agencies correctly note that the costs of the efficiency improvements mandated by the rulemaking are already so low, and in fact cost negative, that cost concerns should not drive further allowances; thus, the Agencies themselves conclude that averaging, trading and banking should be permitted only if they achieve a "net reduction in emissions and fuel use."[45] We fully concur.

We also note that the Agencies appear to use credits as a substitute for appropriate technology-forcing standards. For example, in proposing credits for improving trailer fuel efficiency, the Agencies state that these credits are designed to act as "incentives … to advance new, clean technologies, or [the application of] existing technologies earlier than they would otherwise" be implemented.[46] Again, the Agencies misperceive their statutory mandate, which requires them to set aggressive standards that force technological innovation and early technology adoption, rather than accommodate the opportunity for industry to simply keep doing business as usual. In the case of trailer fuel efficiency measures, this substitution is especially ill conceived, since the technologies at issue already exist. While credits for the application of technologies still in the research phase may be appropriate, they should not be employed as a cover for the Agencies' failure to appropriately weigh the statutory factors to implement maximum fuel efficiency standards.

For similar reasons, "early" compliance credits for greenhouse gas emission reductions and fuel efficiency improvements achieved by manufacturers in the period before the proposed 2016-2018 standards go into effect should be granted only if they achieve true "additionality," and are both quantifiable and verifiable. As in the case of other mechanisms that "offset" pollution, such credits do not advance the goal of achieving the *maximum feasible* energy consumption and the necessary GHG emission reductions unless they create verifiable and truly

[43] *Id.*
[44] *See, e.g.*, Driesen, supra, at 31.
[45] Proposed Rule, 75 Fed. Reg. 74251.
[46] *Id.* at 74253.

additional gains that would not otherwise be achieved.[47] In other words, fuel efficiency improvements already baked into manufacturers' product plans as of the date the Proposed Rule becomes final should be ineligible for credits as those improvements will be implemented regardless of these regulations. Otherwise, these credits will simply delay further investment and innovation in fuel saving technologies and wholly undermine the Agencies' efforts. Accordingly, any "early" credits must be carefully tailored and tightly restricted to avoid these effects.

Deficit "carry-back" credits must be removed. As proposed, manufacturers who fail to comply with the standards for up to three years could earn credits if they exceed the standards in the following year, and use these credits to avoid penalties for having failed to comply in the preceding years. "Carry-back" credits, however, undermine the purpose of the Agencies' efforts not only because they would incentivize delays in investment and technological innovation and thus undercut EPCA's and EISA's intent, but also because the benefits of avoiding the emission of a ton of greenhouse gases today exceed the benefits of avoiding the release of the same ton several years from now. In fact, the Proposed Rule already recognizes this fact but fails to apply it. As the Proposed Rule notes, GHGs remain in the atmosphere for decades and, in the case of CO_2, for millennia: "As a substantial portion of CO_2 emitted into the atmosphere is not removed by natural processes for millennia, each unit of CO_2 not emitted into the atmosphere avoids essentially permanent climate change on centennial time scales."[48] As a consequence, remedial efforts get more expensive the longer they are delayed: "The SCC increases over time because future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed as the magnitude of climate change increases."[49] Even disregarding the potential of triggering catastrophic events and assuming *arguendo* that the SCC grows by no more than a linear 3% per annum as the Agencies assume, it is undoubtedly vastly less costly to remove a given ton of carbon in Year 1 rather than in Year 4, when it has wrought that much more damage.[50] Moreover, as the Agencies have acknowledged elsewhere, "voluntary non-compliance is impermissible for the GHG standards proposed under the CAA."[51] In sum, deficit "carry back" credits are bad economic and environmental policy as well as in violation of EPCA, EISA and the CAA.

Lastly, while over-compliance "carry forward" credits (i.e., the ability to apply credits for over-compliance in Year 1 to remedy compliance failures in Year 1+n) are commendable within limits because they indeed incentivize early technological investment and innovation, and initially accelerate the rate of removal of GHGs from the atmosphere, allowing such "carry forward" credits for more than a year or two is excessive. Long "carry forward" periods simply remove the incentive to incorporate newly developed technology into the nation's vehicle fleet and, after the initial spurt, stagnate rather than drive progress. These detriments could be balanced against the evident benefits of limited "carry forward" credits by selecting a short application period. Moreover, no such credits should be allowed unless a manufacturer can

[47] *See, e.g.*, STOCKHOLM ENVIRONMENT INSTITUTE, *Additionality and Quantification Procedures* (last visited Jan. 26, 2011), *available at* http://www.co2offsetresearch.org/policy/AdditionalityBaselines.html.
[48] Proposed Rule, 74 Fed. Reg. at 74289.
[49] *Id.* at 74322.
[50] For studies that support the conclusion that delay in GHG emission reductions causes increasing damages, s*ee* our January 3, 2011 Comment Letter.
[51] Proposed Rulemaking To Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 74 Fed. Reg. 49454, 49522 (September 28, 2009).

demonstrate additionality and quantify and verify the amount by which its performance actually exceeds the standard.

The Agencies have also requested comments on the size of the fines to be set for non-compliance. Notably, they have reported that in the context of the light duty vehicle market, over the years some manufacturers have *consistently* chosen to pay fines rather than comply with the nation's mileage standards. Fines that are insufficiently high to prevent non-compliance fail to promote the statutory intent. Thus, they should be set at levels that exceed a reasonable estimate of what manufacturers must spend to comply with the standards.

IV. THE AGENCIES SHOULD LOWER THE PROPOSED EMISSIONS CAP FOR METHANE AND NITROUS OXIDE

We support EPA's proposal to cap the emissions of two extremely potent greenhouse gases, nitrous oxide (N_2O) and methane (CH_4),[52] as required by the Endangerment Finding so that future engine technologies or fuels do not result in increases in these emissions (so-called "no backsliding" standards).[53] However, setting these caps at *twice* the current emission levels[54] for these dangerous greenhouse gases is both antithetical to the endangerment finding and unnecessary. The Agencies themselves state that "manufacturers will be able to design and develop the engines and aftertreatment to avoid . . . increased emissions [of nitrous oxide and methane] through appropriate emission control technology selections like those already used and available today. . . EPA believes that these standards can be capped at the same level, regardless of type of HD engine involved . . . [and] there is no reason to believe that emissions will slip to levels close to the [proposed] cap . . . ."[55] In other words, even though EPA believes existing technology can easily prevent methane and nitrous oxide levels from rising above current emission levels, it nonetheless proposes setting a cap that is approximately twice as high as current levels. Contrary to EPA's stated intent, such a high standard would encourage rather than prevent "backsliding." Section 202(a)(3) of the Clean Air Act requires that emission levels for these two powerful pollutants be set at the "greatest degree of emission reductions achievable."[56] Plainly, permitting the doubling of emissions, even though technologies exist that feasibly prevent such an outcome, is a *per* se violation of the Clean Air Act. We strongly urge EPA to adopt methane and nitrous oxide caps that do not exceed current emission levels.

V. CONCLUSION

The need to reduce greenhouse gas emissions and increase HD Vehicles' fuel efficiency to the maximum feasible extent, and to do so as quickly as possible, has never been greater. Current global efforts put future temperature rises on a path that easily exceeds dangerous levels – as the Agencies' forecast of some 670 ppm of CO_2 by 2100 fully attests. To do their part to

[52] As the Agencies correctly observe, nitrous oxide has a global warming potential of 298, and methane has a global warming potential of 25. Proposed Rule, 75 Fed. Reg. 74208-209.
[53] Proposed Rule, 75 Fed Reg. 74207.
[54] *Id* .at 74208-210.
[55] *Id.*
[56] 42 U.S.C. § 7521(a)(3(A).

forestall these effects, the Agencies must do far more than the Proposed Rule envisions. The statutory mandates, the availability of technology that is either on the shelf already or that can be implemented within the rulemaking years, and the overwhelming cost-benefit imbalance that results from the present proposal must propel the Agencies to revise their standards upwards by up to 50 percent.

We appreciate the opportunity to submit these additional comments and thank you for your consideration.

Sincerely,

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ATTACHMENT E

Comments by the Center re: Medium- and Heavy-Duty Fuel Efficiency Improvement Program, Final Environmental Impact Statement, June 2011; Docket No. NHTSA-2010-0079
(July 22, 2011)

CENTER *for* BIOLOGICAL DIVERSITY

VIA UPLOAD TO DOCKET NO. NHTSA-2010-0079 at REGULATIONS.GOV

July 22, 2011

National Highway Traffic Safety Administration
Docket Management Facility, M-30
U.S. Department of Transportation, West Building
Ground Floor, Rm. W12-140
1200 New Jersey Avenue, S.E.
Washington, DC 20590
Attn: NHTSA-2010-0079

Re: Medium- and Heavy-Duty Fuel Efficiency Improvement Program, Final Environmental Impact Statement, June 2011; Docket No. NHTSA-2010-0079

The Center for Biological Diversity (the "Center") hereby supplements the record for and submits brief comments concerning the Medium- and Heavy-Duty Fuel Efficiency Improvement Program, Final Environmental Impact Statement, June 2011 ("FEIS"). The Center is a non-profit environmental organization dedicated to the protection of imperiled species, their habitats, and the environment through science, policy, and environmental law. The Center has over 330,000 members and online activists throughout the United States. These comments are filed on behalf of our members and staff with a vital interest in reducing greenhouse gas and other air pollutants.

a. <u>New Peer-Reviewed Studies.</u>

Since January 2011, when we submitted our letter commenting on the DEIS, a number of peer-reviewed scientific studies have been published that should inform the final rulemaking for medium-and heavy-duty vehicles ("HD Vehicles"). These studies are listed in Exhibit A attached hereto and fully incorporated herein by reference. Each contributes important new information concerning the damage to human health and welfare and the environment caused by greenhouse gas emissions, and we urge the National Highway Transportation and Safety Agency ("NHTSA" or the Agency) to take them into account as it finalizes the rulemaking for HD Vehicles.

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b. NHTSA's Exclusion of Available Fuel Efficiency Improvement Technologies.

The vast majority of the comments submitted in response to the draft environmental impact report requested NHTSA to *increase* the stringency of the standards for HD vehicles that the Agency has proposed. They note, *inter alia*, that the alternatives the Agency has presented fail to require the utilization of cost-effective technologies currently available and in use which increase fuel efficiency and decrease greenhouse gas emissions, including, for example, idling reduction techniques, tire technology and speed limiters. In justifying its decisions against requiring the use of these and other technologies, the Agency frequently reiterates its belief that it has discretion in setting "maximum feasible" standards as required by the Energy Policy Conservation Act and the Energy Independence and Security Act ("EPCA/EISA)[1] by balancing technological feasibility against appropriateness and cost efficiency, and that it need not include "all available technologies in setting heavy-duty standards" even though EPCA/EISA indeed are technology forcing statutes. [2]

These statements and actions display a profound misapplication of the statutory mandate. In short, it is arbitrary and capricious, and against the law, to fail to require the use of fuel-efficiency improvement technologies that are not only technically feasible but indeed are in use today, are appropriate for the vehicles in question and deliver benefits exceeding their costs. NHTSA has no discretion to exclude available technology that improves fuel efficiency unless it can demonstrate that the technology is either inappropriate or cost-prohibitive. That is so for the underlying rulemaking because it requires maximum feasible fuel efficiency improvement. It is

[1] EPCA's goals are to decrease the nation's dependence on foreign imports, to enhance national security and to achieve the efficient utilization of scarce resources. *Center for Biological Diversity v. NHTSA*, 508 F.3d 508, 514 (9th Cir. 2007). To achieve these goals, EPCA, as amended by EISA, expressly demands that NHTSA set *maximum feasible* fuel economy standards. 49 U.S.C. § 32902(a). In the case of HD Vehicles, Section 32902(k) of EPCA requires NHTSA to set standards and implement a HD Vehicle "fuel efficiency improvement program *designed to achieve the maximum feasible improvement*." *Id.*¸§ 32902(k)(2) (emphasis added). The requisite standards shall be "appropriate, cost-effective, and technologically feasible for commercial medium-and heavy-duty on-highway vehicles and work trucks." *Id.* In fulfilling its duties under Section 32902(a), NHTSA "cannot set fuel economy standards that are contrary to Congress's purpose in enacting the EPCA – energy conservation," it cannot act arbitrarily and capriciously; it cannot advance conclusions unsupported by the evidence; if it conducts cost-benefit analyses, it may not assign values of zero to benefits that can be ascertained within a range; and it cannot bias its cost-benefit analysis. *Center for Biological Diversity v. NHTSA*, *supra*, 508 F.3d at 531, 534. In addition, EPCA and EISA are meant to encourage technological innovation in the field, not simply promote the wider adoption of existing technologies. *See, e.g., Center for Auto Safety v. Thomas*, 847 F.2d 843, 870 (D.C. Cir. 1988) (overruled on other grounds) ("[t]he experience of a decade leaves little doubt that the congressional scheme in fact induced manufacturers to achieve major technological breakthroughs as they advanced towards the mandated goal"); *Green Mt. Chrysler Plymouth Dodge Jeep v. Crombie*, 508 F. Supp. 2d 295, 358-359 (D. Vt. 2007) (discussing technology-forcing character of EPCA and the use of increased fuel efficiency to augment performance rather than mileage): *Kennecott Greens Creek Min. Co. v. Mine Safety and Health Admin.*, 476 F.3d 946, 957 (D.C. Cir. 2007) ("when a statute is technology forcing, the agency can impose a standard which only the most technologically advanced plants in an industry have been able to achieve – even if only in some of their operations some of the time"). The Clean Air Act is similarly technology-forcing. Legislative history indicates that the primary purpose of the Act was not "to be limited by what is or appears to be technologically or economically feasible," which may mean that "industries will be asked to do what seems impossible at the present time." 116 Cong. Rec. 32901-32902 (1970), Legislative History of the Clean Air Amendments of 1970 (Committee Print compiled for the Senate Committee on Public Works by the Library of Congress), Ser. No. 93-18, p. 227 (1974); *see also Whitman v. American Trucking Association*, 531 U.S. 457, 491 (2001).

[2] *E.g.*, FEIS at 6-37, 6-60.

also true for the development and presentation of alternatives in the FEIS, which must analyze the environmental impacts of each in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker and the public.[3] NHTSA must explain why its Preferred Alternative does in fact deliver the maximum feasible fuel efficiency improvement in light of the environmental impacts, costs and benefits at stake.[4]

Here, contrary to these mandates, the proposed HD Vehicle rule and its analysis in the FEIS excludes feasible and cost-effective technologies that are in use in the HD Vehicle fleet today [5] NHTSA essentially admits that this is so, acknowledging that the SmartWay Transportation Partnership program, a program NHTSA promotes and has worked with for six years, successfully utilizes some of the very technologies it excludes from its rulemaking.[6] NHTSA's mandate under EPCA/EISA, however, is not to promote voluntary "partnerships" with like-minded individual industry participants, hoping for the best, but to *mandate* that the nation's entire HD Vehicle fleet deliver maximum feasible fuel efficiency improvements. The comments submitted to NHTSA by us and others demonstrate that NHTSA's proposals fall far short of what is feasible, and what is therefore required.

c. NHTSA Understates the Environmental Benefits of Greenhouse Gas Reductions and Fuel Efficiency Improvements by Tremendous Amounts

The major underlying rationale for the Agency's rejection of available technologies is its assertion that implementation would not be cost effective, whether based on the cost of technology itself, strict adherence to industry "refresh/redesign" manufacturing cycles, or other reasons.[7] However, the cost-benefit analysis underlying this conclusion falls so far short of the mark as to be arbitrary and capricious. Comment letters by us and others point out this error.

Here we draw particular attention to one of the new studies submitted with this comment letter, a study by Frank Ackerman and Elizabeth Stanton,[8] that points out the severe distortions underlying one of NHTSA's key cost-benefit analysis assumptions, the value of the social cost of carbon ("SCC"), for which NHTSA relies on the work performed by the interagency working group on the social cost of carbon (the "working group"). As also pointed out by our earlier comments, by others and in the literature we have cited previously, the working group's calculations arbitrarily omit many of the biggest risks associated with climate change and grossly undervalue the impact of current emissions on future generations. By adjusting the DICE model to accurately reflect the true range of four major areas of uncertainty, Ackerman and Stanton conclude that the value of the SCC in 2010 ranges from $28 to $893 per ton of carbon, rather than the value of $21 arrived at by the working group, and that this value rises up to $1,550 in 2050.[9] The uncertainties adjusted by Ackerman and Stanton to reflect the current scientific

[3] 40 C.F.R. § 15002.14.
[4] 40 C.F.R. § 15002.14(e).
[5] As set forth in our earlier letter, the alternatives also incorrectly exclude technologies currently under development, even though EPCA/EISA are technology forcing statutes.
[6] *See, e.g.,* FEIS at 1-4, 6-54, 6-57.
[7] *See, e.g.* FEIS at 6-26.
[8] FRANK ACKERMAN & ELIZABETH STANTON, CLIMATE RISKS AND CARBON PRICES: REVISING THE SOCIAL COST OF CARBON CHANGE (2011), *available at* http://www.sei-us.org/publications/id/399 ("Ackerman & Stanton").
[9] *Id.* at 13-14.

understanding are the sensitivity of the climate to greenhouse gas emissions, the level of economic damages expected at lower temperatures, the level of damages expected at higher temperatures, and the discount rate.[10] Using reasonable rather than arbitrarily deflated inputs for these uncertainties – fully supported by the literature previously cited and by the new studies included here – the true value of the SCC emerges, and NHTSA's assertions that technologies must be discarded because they are supposedly too expensive simply no longer stand.

In its response to comments, NHTSA acknowledges faults in the working group's SCC assumptions, recognizing "the need for a thorough review of damage functions – in particular, how the models incorporate adaptation, technological change, and catastrophic damages."[11] But NHTSA states that it will nonetheless rely on the working group's estimates, pointing to the hope that the group may soon revise its calculations. Perplexingly, NHTSA then offers to "consider these comments [demonstrating that the working group's numbers do not withstand scrutiny] when the current SCC estimates are updated."[12] But NHTSA must undertake its own evaluation of the assumptions underlying the cost-benefit analysis it uses to exclude fuel efficiency improvement technology from its rulemaking, and it must do so now and cannot wait for some other body's potential future work. All the tools to arrive at accurate conclusions are at NHTSA's disposal. In setting standards that will affect the nation's HD Vehicle fleet for decades to come, NHTSA simply cannot use data that is outdated and grossly off the mark. We urge the Agency to use the literature cited herein and elsewhere to arrive at a SCC that can be factually supported.[13]

We also note here NHTSA's refusal to include a source we have cited, *Hansen et al.* (2008),[14] in its analysis based on the belief that "this source did not appear to have been extensively peer- or panel-reviewed."[15] That is not the case. The Open Atmospheric Science Journal, in which this study is published, is publicly available, reflecting a growing movement towards making scientific information more accessible. It is also peer-reviewed, like other scientific publications.[16] Thus, we urge NHTSA to include it in its consideration.

We appreciate the opportunity to submit these additional comment and references, and thank you for your consideration.

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[10] *Id.* at 3.
[11] FEIS at 6-88.
[12] FEIS at 6-87.
[13] Admitting that its cost-benefit analysis is in error also because its calculation of the SCC stops after 2050, NHTSA performs a "sensitivity analysis" in which it quickly concludes that calculating the SCC beyond 2050 does not influence the relative effectiveness of the alternatives it proposes. FEIS at 6-88, 6-89. This outcome simply proves the point that the context in which NHTSA generally presents the environmental effects of its alternatives is irredeemably flawed, as it minimizes their impact to the point that it appears NHTSA's choices are irrelevant. But even under that flawed presentation, differences would indeed become apparent if the SCC were valued correctly.
[14] J. Hansen et al., *Target Atmospheric CO2: Where Should Humanity Aim?*, OPEN ATMOSPHERIC SCIENCE JOURNAL 2 (2008).
[15] FEIS at 6-98.
[16] *See* Bentham Open, The Open Atmospheric Science Journal, , http://www.benthamscience.com/open/toascj/MSandI.htm (last visited July 22, 2011).

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Exhibit A

Frank Ackerman & Elizabeth Stanton, Climate Risks and Carbon Prices: Revising the Social Cost of Carbon Change (2011), *available at* http://www.sei-us.org/publications/id/399.

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ATTACHMENT F

A brief summary of current climate science prepared by Center for Biological Diversity scientific staff, and updated as of October 2013

Center for Biological Diversity
Climate Change Science Summary
Updated October 2013

I. The International Scientific Consensus on Climate Change

There is a strong, international scientific consensus that anthropogenic climate change is occurring, is primarily human-induced, and threatens human society and natural systems. The Intergovernmental Panel on Climate Change (IPCC) in its 2013 Fifth Assessment Report stated that that warming of climate system is unequivocal: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" (IPCC 2013). The IPCC also concluded with high confidence that most of the recent warming is caused by human activities: "It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century" (IPCC 2013). The U.S. Global Change Research Program in its 2009 report *Climate Change Impacts in the United States* similarly stated that "global warming is unequivocal and primarily human-induced" and "widespread climate-related impacts are occurring now and are expected to increase" (Karl et al. 2009). The U.S. National Research Council similarly concluded that "[c]limate change is occurring, is caused largely by human activities, and poses significant risks for—and in many cases is already affecting—a broad range of human and natural systems" (NRC 2010a). Based on observed and expected harms from climate change, in 2009 the U.S. Environmental Protection Agency concluded that greenhouse gas pollution endangers the health and welfare of current and future generations.[1]

II. Climate Change is Already Resulting in Severe and Significant Impacts Worldwide, and These Threats Will Worsen as Emissions Continue to Rise

A. Global greenhouse gas emissions are tracking the most fossil-fuel intensive IPCC emissions scenario

Due to U.S. and international failures to adequately address climate change, greenhouse gas emissions are increasing at an accelerating pace. Carbon dioxide (CO_2) is the dominant greenhouse gas driving the observed changes in the Earth's climate (NRC 2011a). The atmospheric concentration of CO_2 reached ~395 parts per million (ppm) in 2012 (NOAA 2013) compared to the pre-industrial concentration of ~280 ppm. The current CO_2 concentration has not been exceeded during the past 800,000 years (IPCC 2013) and perhaps not during the past 15 to 20 million years (Tripati et al. 2009). Atmospheric CO_2 emissions have risen particularly rapidly since the 2000s (Raupach et al. 2007, Friedlingstein et al. 2010). The global fossil fuel CO_2 emissions growth rate was 1.1% per year during 1990-1999 compared with 3.1% during 2000-2010 (Global Carbon Project 2011). Since 2000 this growth rate has largely tracked or exceeded the most fossil-fuel intensive emissions scenarios projected by the IPCC, the A1FI and RCP8.5 scenarios (Peters et al. 2012).

[1] U.S. Environmental Protection Agency, Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, 74 Federal Register 66496 (2009).

B. Current greenhouse gas emissions are resulting in severe and significant climate change impacts which will worsen as emissions rise

Current atmospheric concentrations of greenhouse gases are already resulting in significant climate change impacts that are projected to worsen as emissions rise (Karl et al. 2009). Key changes include warming temperatures, the increasing frequency of extreme weather events, rapidly melting glaciers, ice sheets, and sea ice, rising sea levels, and a thirty percent increase in surface ocean acidity (Karl et al. 2009, IPCC 2013).

The average global temperature has warmed by more than 0.85 degrees Celsius (1.5 degrees Fahrenheit) since the industrial revolution, most of which has occurred in the past three decades (IPCC 2013). In the United States, temperatures have warmed by more than 1.1°C (2ºF) over the past 50 years, with the greatest warming in Alaska (Karl et al. 2009). Globally, the decade from 2000 to 2010 was the warmest on record (NASA 2012), and 2005 and 2010 tied for the hottest years on record (NOAA 2012a). By the end of this century, the average temperature in the United States is expected to increase by 2.2 to 3.6°C (4 to 6.5°F) under a lower emissions scenario and by 3.9 to 6.1°C (7 to 11°F) under a higher emissions scenario (Karl et al. 2009).

Extreme weather events are striking with increasing frequency, most notably heat waves and precipitation extremes such as droughts and floods (Karl et al. 2009, IPCC 2012, Coumou and Rahmstorf 2012). In the United States in 2011 alone, a record 14 weather and climate disasters occurred, including droughts, heat waves, and floods, that cost at least $U.S. 1 billion each in damages and loss of human lives (NOAA 2012b, WMO 2012). Summertime heat extremes[2] which covered much less than 1% of Earth's surface during 1951-1980 now cover about 10% of the Earth's land area, and extreme heat anomalies such as the record heat waves that hit Texas and Oklahoma in 2011 can be attributed with a high degree of confidence to global warming (Hansen et al. 2012).

The Arctic has experienced some of the most severe and rapid warming associated with climate change, warming at twice the rate of the rest of the globe on average (Trenberth et al. 2007). Arctic summer sea ice extent and thickness have decreased to about half of what they were several decades ago (Stroeve et al. 2008, Kwok and Rothrock 2009), with an accompanying drastic reduction in volume (Schweiger et al. 2012). In September 2012, Arctic summer sea ice extent reached a new record low, falling to half the average size of summer sea ice between 1979 and 2000 (NSIDC 2012). A nearly ice-free Arctic in summer is expected by mid-century or before, with estimates of 2020 or earlier, 2030 on average, and 2040 or later based on three modeling approaches (Overland and Wang 2013). Arctic warming and the loss of sea ice have been linked to the increased frequency of extreme weather events, including droughts, floods, heat waves, and cold spells, in the United States and other mid-latitude regions of the Northern Hemisphere due to disruption of the jet stream (Francis and Vavrus 2012). Glaciers and ice sheets are also rapidly melting, threatening water supplies in many regions and raising sea levels (IPCC 2013).

[2] Summertime heat extremes are defined as more than three standard deviations (3σ) warmer than the climatology of the 1951–1980 base period.

Global average sea level rose by roughly eight inches (19 centimeters) over the past century, and sea level rise is accelerating in pace (Karl et al. 2009, IPCC 2013). Recent studies indicate that a global mean sea level rise of 3 to 4 feet is likely within this century, and 6.6 feet is possible. These studies project a global mean sea level rise ranging between 1.6 feet (0.5 meters) and 6.6 feet (2 meters) by 2100 using both semi-empirical and process-based models: 0.5 to 1.4 m (Rahmstorf 2007), 0.75 m to 1.90 m (Vermeer and Rahmstorf 2009), 0.8 m to 2.0 m (Pfeffer et al. 2008), 0.8 m to 1.3 m (Grinsted et al. 2010), and 0.6 m to 1.6 m (Jevrejeva et al. 2010). In its 2012 sea-level rise assessment, the National Research Council estimated global sea-level rise at 8 to 23 cm by 2030, 18 to 48 cm by 2050, and 0.5 m to 1.4 m by 2100 (NRC 2012). In its 2013 Fifth Assessment, the IPCC estimated global sea-level rise in 2100 at 0.52 m to 0.98 m under the high emissions RCP 8.5 pathway, using process-based models and not semi-empirical models which estimate higher rates of rise (IPCC 2013). As summarized by Sriver et al. (2012), a two meter sea level rise is generally considered a reasonable upper bound for sea-level rise in this century: "more recent studies considering semi-empirical modeling approaches and kinematic constraints on glacial melting suggest a reasonable 2100 SLR upper bound of approximately 2 m."[3] However, studies that have reconstructed sea-level rise based on the geological record indicate that larger rates of rise are possible (Hansen et al. 2008, Milne et al. 2009).

Sea-level rise will be exacerbated by increasing storm intensity and storm surge (Meehl et al. 2007). The frequency of high-severity hurricanes is increasing in the Atlantic (Trenberth et al. 2007, Elsner et al. 2008, Saunders and Lee 2008, Bender et al. 2010, Kishtawal et al. 2012), as is the frequency of hurricane-generated large surge events—the offshore rise in water created and pushed ashore by storm winds (Grinsted et al. 2012). The risk of extreme Katrina-magnitude storm-surge events has already doubled, and scientists estimate a twofold to sevenfold increase in the frequency of extreme surge events for each 1ºC rise in global temperature (Grinsted et al. 2013). As sea level rises, storm surge rides on a higher sea surface which pushes water further inland and creates more flooding of the coasts (Tebaldi et al. 2012).

C. Climate change impacts are delayed, long-lasting, and will be amplified by crossing tipping points and feedbacks

The climate impacts from the greenhouse gases currently in the atmosphere have not been fully realized, and many climate impacts will be very long-lasting. Due to thermal inertia in the climate system, there is a time lag between the emission of greenhouse gases and the full physical climate response to those emissions, called the "climate commitment." If the current concentrations of greenhouse gases were to be maintained near today's levels, the Earth would be committed to additional warming estimated at 0.6°C to 1.6°C within this century, depending on the level of aerosol unmasking (Meehl et al. 2007).[4] Furthermore, due to the long atmospheric lifetime of CO_2, climatic changes that are caused by CO_2 emissions, such as surface warming, ocean warming, sea level rise, and ocean acidification are long-lasting and irreversible

[3] Importantly, Sriver et al. (2012) found that uncertainties surrounding thermal expansion of the ocean and observational constraints on ocean heat uptake increase the reasonable upper bound of 2100 SLR projections by 0.25 m, meaning the upper bound on sea-level rise by 2100 is likely higher than two meters.

[4] Aerosols are human-generated pollution particles like sulfates and nitrates that block solar radiation and produce a cooling effect that masks the full extent of global warming. When these particles are removed by air pollution control technologies, their cooling effect is reduced and warming is "unmasked."

on human timescales (Archer and Brovkin 2008, Solomon et al. 2009). For example, even if all greenhouse emissions were to completely cease today, significant ongoing regional changes in temperature and precipitation would still occur (Gillett et al. 2011), global average temperatures would not drop significantly for at least 1,000 years (Archer and Brovkin 2008, Solomon et al. 2009), and sea-level rise would continue for millennia (Solomon et al. 2009). As summarized by the IPCC, "a large fraction of anthropogenic climate change resulting from CO_2 emissions is irreversible on a multi-century to millennial time scale, except in the case of a large net removal of CO_2 from the atmosphere over a sustained period. Surface temperatures will remain approximately constant at elevated levels for many centuries after a complete cessation of net anthropogenic CO_2 emissions. Due to the long time scales of heat transfer from the ocean surface to depth, ocean warming will continue for centuries. Depending on the scenario, about 15 to 40% of emitted CO_2 will remain in the atmosphere longer than 1,000 years" (IPCC 2013: SPM-20). The U.S. National Research Council cautioned that "emission reduction choices made today matter in determining impacts that will be experienced not just over the next few decades, but also into the coming centuries and millennia"(NRC 2011b).

Growing emissions have the potential to trigger "tipping points," critical points in the climate system where even small increases in warming trigger a rapid switch to a qualitatively different state that can be irreversible for millennia (Lenton et al. 2008, Molina et al. 2009, Schellnhuber 2009). Warming from rising greenhouse gas emissions also reinforces positive feedback cycles that can further amplify warming. In the Arctic, the ice-albedo feedback loop is already occurring; as the highly reflective sea ice melts, more of the sun's energy is absorbed by the underlying darker seawater, spurring the Arctic to heat up at an ever-faster pace. Increasing temperatures are expected to trigger other feedbacks including the release of large stores of carbon and methane from melting Arctic permafrost (Archer and Brovkin 2008, Koven et al. 2011).

D. Limiting global temperature rise to 1.5°C or 2°C

Recent international agreements have focused on a goal of limiting global temperature increase to 2°C above pre-industrial levels to "prevent dangerous anthropogenic interference with the climate system" as required by the United Nations Framework Convention on Climate Change (UNFCCC 2012).[5] However, studies have found that a 2°C temperature increase above pre-industrial levels is past the point where severe and potentially irreversible impacts will occur, including significant risks to food and water security in many regions of the world, the disappearance of the Arctic summer sea ice, a elevated probability of triggering the irreversible melting of the Greenland ice sheet, an increased risk of extinction for 20-30% of species on Earth, the dieback of 30% of the Amazon rainforest, and "rapid and terminal" declines of coral reefs worldwide with serious consequences for the half billion people who depend on coral reefs directly for their livelihoods (Jones et al. 2009, Smith et al. 2009, Veron et al. 2009, Warren et al. 2011, Hare et al. 2011, Frieler et al. 2012). As summarized by a recent study, the impacts associated with 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change" (Anderson and Bows 2011).

[5] The non-legally binding Cancún Agreement of 2010 and Copenhagen Accord of 2009 recognize the objective of limiting warming to 2°C above pre-industrial.

Because a 2°C target is associated with significant harms, prominent climate scientists and governments have urged a target of 1.5°C to avoid dangerous climate change (Hansen et al. 2008, Rockström et al. 2009), which roughly corresponds to reducing the atmospheric CO_2 concentration to 350 ppm (Hare and Schaeffer 2009).[6] Limiting warming to 1.5°C has been called for by the Alliance of Small Island States, the Least Developed Countries, and Executive Secretary of the United Nations Framework Convention on Climate Change Christiana Figueres. As climate scientist Dr. James Hansen and colleagues concluded, "if humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm [equivalent to ~1.5°C], but likely less than that" (Hansen et al. 2008). This 350 ppm target must be achieved within decades to prevent dangerous tipping points and "the possibility of seeding irreversible catastrophic effects" (Hansen et al. 2008).

In order to preserve a likely chance of limiting temperature rise to 1.5° or 2°C above pre-industrial levels, recent scientific assessments have found that global emissions must peak by 2020, decline sharply thereafter, reach zero net emissions by 2050, and become net-negative after 2050 (e.g., net-negative means that more carbon is removed from the atmosphere than is produced) (Baer et al. 2009, Höhne et al. 2009a, 2009b, Rogelj et al. 2011, UNEP 2010a, UNEP 2011). Scientists have estimated that cumulative CO_2 emissions must not exceed 1000 $GtCO_2$ (gigatonnes CO_2) between 2000 and 2050 in order to have a 75% chance of staying below 2°C (Meinshausen et al. 2009, NRC 2011a) and must not exceed 750 to 824 $GtCO_2$ between 2000 and 2050 to meet a 350ppm CO_2/1.5°C target (Ackerman et al. 2009, Baer et al. 2009). Because pathways for 1.5°C and 2°C require staying within a tight cumulative carbon budget, continuing increases in greenhouse gas emissions and corresponding delays in reaching a global emissions peak make it increasingly difficult to meet these targets. For example, global emissions from 2000 to 2010 accounted for roughly 360 $GtCO_2$, which is a third of the allowed emissions until 2050 consistent with a 75% chance of staying within 2°C and nearly half of the allowed emissions consistent with staying within 1.5°C (Höhne et al. 2009a). Thus, global emissions in the past decade have eliminated a large portion of the available carbon budget, and every year at current emissions (~33 $GtCO_2$) consumes a significant share and makes meeting this budget less feasible.

Achieving a target of limiting warming to 1.5°C or 2°C is still technologically feasible, but this goal is being jeopardized by failures to slow greenhouse gas emissions and forge a binding international greenhouse gas reduction agreement (Blok et al. 2012, Vieweg et al. 2012). Even if countries were to meet their non-binding pledges under the Copenhagen and Cancún agreements to cut greenhouse gas emissions, these inadequate national pledges would lead to 2.5°C to 5°C warming (Rogelj et al. 2010, UNEP 2010a, UNEP 2011), with a likely rise of 3.5°C or more (Höhne et al. 2012). In short, every additional contribution to global greenhouse gas emissions, especially over the next few decades, means that meeting a 1.5°C or 2°C target becomes less likely and pushes the Earth further toward tipping points, enhances positive

[6] An analysis of low emissions pathways found that only those that approach 350 ppm by 2100 have a reasonable probability (40–60%) of limiting warming to 1.5°C.

feedback loops that amplify warming, and increases the probability of dangerous climatic changes.

III. Observed and Projected Climate Change Impacts in the United States

A. Biodiversity

Anthropogenic climate change poses a significant threat to biodiversity. Climate change is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extirpations (Parmesan and Yohe 2003, Root et al. 2003, Parmesan 2006, Chen et al. 2011, Maclean and Wilson 2011, Warren et al. 2011, Cahill et al. 2012). Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to result in catastrophic species losses during this century. The IPCC concluded that 20% to 30% of plant and animal species will face an increased risk of extinction if global average temperature rise exceeds 1.5°C to 2.5°C relative to 1980-1999, with an increased risk of extinction for up to 70% of species worldwide if global average temperature exceeds 3.5°C relative to 1980-1999 (IPCC 2007). Other studies have predicted similarly severe losses: 15%-37% of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario (Thomas et al. 2004); the potential extinction of 10% to 14% of species by 2100 if climate change continues unabated (Maclean and Wilson 2011); and the loss of more than half of the present climatic range for 58% of plants and 35% of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species (Warren et al. 2013). Scientists have warned that the Earth is fast approaching a global "state-shift" that could result in unanticipated and rapid changes to Earth's biological systems (Barnosky et al. 2012).

B. Ocean Acidification

The ocean's absorption of anthropogenic CO_2 has already resulted in more than a 30% increase in the acidity of ocean surface waters, at a rate likely faster than anything experienced in the past 300 million years, and ocean acidity could increase by 150% to 200% by the end of the century if CO_2 emissions continue unabated (Orr et al. 2005, Feely et al. 2009, Hönisch et al. 2012). Ocean acidification negatively affects a wide range of marine species by hindering the ability of calcifying marine creatures to build protective shells and skeletons and by disrupting metabolism and critical biological function (Fabry et al. 2008, Feely et al. 2009, Kroeker et al. 2013). The adverse effects of ocean acidification are already being observed in wild populations, including reduced coral calcification rates (De'ath et al. 2009), reduced shell weights of foraminifera in the Southern Ocean (Moy et al. 2009), and mass die-offs of larval Pacific oysters in the Pacific Northwest (Barton et al. 2012).

Coral reef ecosystems, which are estimated to harbor one-third of marine species and which support the livelihoods of a half billion people, are particularly threatened by ocean acidification. Some corals are already experiencing reduced calcification (Cooper et al. 2008, Gledhill et al. 2008, De'ath et al. 2009, Bates et al. 2010). Due to the synergistic impacts of ocean acidification, mass bleaching, and other stresses, reefs are projected to experience "rapid

and terminal" declines worldwide at atmospheric CO_2 concentrations of 450 ppm (Veron et al. 2009). Prominent coral scientists have called for reducing atmospheric CO_2 to less than 350 ppm to protect coral reefs from collapse (Veron et al. 2009, Frieler et al. 2012).

Numerous U.S. and international scientific and policy bodies have identified ocean acidification as an urgent threat to ocean ecosystems, food security, and society (NRC 2010b, UNEP 2010b, Rogers and Laffoley 2011). The United Nations Environment Programme concluded that ocean acidification's impact on marine organisms poses a threat to food security and the billions of people that rely on a marine-based diet (UNEP 2010b). Moreover, a recent study estimated that the damage our oceans will face from emissions-related problems will amount to $428 billion a year by 2050 and nearly $2 trillion per year by the century's end (Noone et al. 2012).

C. Coastal Impacts of Sea-level Rise

More than half (52%) of U.S. residents live in coastal counties (NOAA 2012c), while an estimated 40% of U.S. endangered species inhabit coastal ecosystems (LeDee et al. 2010), highlighting the threats of sea-level rise to coastal communities. Sea levels on the U.S. East Coast from Cape Hatteras to Boston are rising three to four times faster than the global average, putting major U.S. cities at increased risk of flooding and storm surges (Sallenger et al. 2012). A nation-wide study estimated that approximately 3.7 million Americans live within one meter of high tide and are at extreme risk of flooding from sea-level rise in the next few decades, with Florida as the most vulnerable state followed by Louisiana, California, New York and New Jersey (Strauss et al. 2012). In Louisiana, rising seas will lead to the permanent flooding of the Mississippi River delta and the loss of 10,000 km^2 to 13,500 km^2 of coastal lands by 2100 (Blum and Roberts 2009). Along the U.S. West Coast, sea-level rise will be greatest off the California, with sea levels expected to increase by as much as 30 centimeters (1 foot) in the next 20 years, 61 centimeters (2 feet) by 2050, and 1.7 meters (more than 5 feet) by the end of the century (NRC 2012). In California, a sea-level rise of 1.4 meters would put 480,000 people and $100 billion worth of property at risk of flooding (Heberger et al. 2011).

D. Water Resources

Climate change is altering the water supply in the United States, placing additional burdens on already stressed water systems (Karl et al. 2009). In the western U.S., mountain snowpack is declining (Hamlet et al. 2005, Mote et al. 2005, Mote 2006, Barnett et al. 2008) and snowmelt is shifting earlier, leading to even lower water supplies in late summer (Stewart et al. 2004). In the southwestern U.S., precipitation has decreased during the summer and fall, and droughts are becoming more severe (Cayan et al. 2010). In the Colorado River Basin, the biggest regional water reservoirs—Lake Powell and Lake Mead—declined from nearly full in 1999 to about 50% full in 2004 due to severe drought and reduced Colorado River flow, and they have not yet recovered, disrupting the region's water supply system (Overpeck and Udall 2010).

Even a lower level of warming of 1 to 2ºC by the middle of the century is projected to result in a number of water-limiting effects across the country. Reductions in western snowpack will create a shortfall in meeting current water demands in many areas, not to mention increased

future demand resulting from population and economic growth (Barnett et al. 2004). Dry events in the Southwest are expected to increase from a historic duration of 4 to 10 years to 12 years or more, and these severe future droughts will be aggravated by lower spring snowpack and soil moisture (Cayan et al. 2010). By 2100, reductions in precipitation could result in decreases in water runoff in the Colorado River Basin of up to 20% (USGS 2011). The intensity and frequency of floods and droughts is also projected to increase, with rainfall becoming concentrated into fewer, heavier events (Karl et al. 2009). Changes in historical patterns of the water cycle will increasingly compromise the national water supply in a way that threatens numerous sectors, from public health and energy, to agriculture and ecosystems (Karl et al. 2009).

E. Food Security

Climate change affects food security through a number of complex pathways, both direct and indirect, including the reduced ability of crops to thrive, increased threats to livestock, climate-related contamination of food supplies, and an alteration in land use patterns and availability. Higher levels of warming and extreme weather events such as droughts and flooding are expected to negatively affect the growth and yields of many crops (Karl et al. 2009). Changes in winter chill conditions by the middle to end of the 21st century will no longer support some of the main tree crops currently grown in California (Luedeling et al. 2009). Warming is likely to benefit many weeds, diseases, and insect pests, increasing stress on crop plants and requiring more pest and weed control (Karl et al. 2009). Increasing CO_2 concentrations are expected to lead to declines in forage quality in pastures and rangelands for livestock, while increased heat, disease, and weather extremes will increase livestock mortality (Karl et al. 2009).

Temperature increases, changes in rainfall, and extreme weather events are projected to increase the incidence and intensity of food-borne diseases and food contamination, jeopardizing food security (Tirado et al. 2010). Ocean warming and ocean acidification will threaten marine food resources by disrupting marine communities, promoting harmful algal blooms and the spread of some diseases, and increasing contaminants in fish and shellfish (Tirado et al. 2010). For example, future ocean and weather patterns are likely to bring longer seasons of Harmful Algal Bloom outbreaks in Puget Sound, which could translate to longer fishery closures and threaten the state's $108 million annual shellfish industry (NOAA 2011).

F. Public Health

Climate change poses an increasing threat to human health, through increases in heat waves and other extreme weather events, aliments caused or exacerbated by air pollution and airborne allergens, and the increased occurrence of climate-sensitive infectious diseases (Karl et al. 2009). Certain groups such as children, the elderly, the poor, and minorities are particularly vulnerable to climate-related health effects (Karl et al. 2009).

Heat is already the leading cause of weather-related deaths in the United States, and a recent study estimated that more than 150,000 Americans may die by the end of the century due to excessive heat caused by climate change (Knowlton et al. 2012). Heat-wave related deaths in Chicago would more than double by 2050 under a lower emissions scenario and quadruple under

a high emissions scenario, while in Los Angeles, annual heat-related deaths are projected to increase by two to three times by the end of the century under a lower emissions scenario and by five to seven times under a higher emissions scenario, compared to a 1990s baseline (Karl et al. 2009). Extreme precipitation, which has increased in the Midwest, South and other regions by 50% mostly over the last few decades (Karl et al. 2009), poses significant human health risks including contaminated drinking water leading to disease outbreaks, drowning, and mold-related illnesses (UCS 2012). An increase in the intensity of Atlantic hurricanes would also have severe health risks. More than 2,000 Americans were killed in the 2005 hurricane season, more than double the average number of lives lost to hurricanes in the United States over the previous 65 years (Karl et al. 2009).

Air pollution components that trigger asthma attacks, specifically air particulates and ozone, are expected to increase with climate change (Bernstein and Myers 2011). Asthma remains a leading cause of morbidity and school absenteeism in the United States. Projected climate-related increases in ground-level ozone concentrations in 2020 could lead to an average of 2.8 million more occurrences of acute respiratory symptoms, 944,000 more missed school days, and over 5,000 more hospitalizations for respiratory-related problems (UCS 2011). In 2020, the continental U.S. could pay an average of $5.4 billion (2008$) in health impact costs associated with the climate penalty on ozone, with California experiencing the greatest estimated impacts averaged at $729 million (UCS 2011).

Infectious diseases also pose an increased threat in a changing climate. There are an estimated 38 million cases of food and water-borne illness in the U.S. each year, caused in part by an increasing number of pathogens in the wake of extreme weather events such as droughts, flooding, and hurricanes (Maibach et al. 2011). Meanwhile, warming climates favors the spread of some pathogen-carrying vectors. Lyme disease is the most common vector-borne disease in the United States, with 25,000–30,000 cases reported to the CDC per year, with the highest incidence among children between ages 5 and 9 (Bernstein and Myers 2011). A recent study suggests that outbreaks of the vector-borne West Nile Virus are potentially related to higher summer temperatures and extreme variation in precipitation (Paz 2012).

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