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12/05/2007 02:31 PM

To Dina Kruger

cc

bcc

Subject Fw: Draft endangerment preamble

Jason Burnett
----- Original Message -----

From: Jason Burnett
Sent: 12/05/2007 02:22 PM EST
To: Nicole Owens
Subject: Fw: Draft endangerment preamble

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----- Forwarded by Jason Burnett/DC/USEPA/US on 12/05/2007 02:21 PM -----

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12/05/2007 02:15 PM

To Susan Dudley

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Subject Draft endangerment preamble

Susan,
Attached is the post-FAR draft endangerment preamble.

Endangerment preamble post FAR 120507 to transmit.doc

Thank you,
Jason

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Draft Outline of Summary of Proposed Endangerment Finding in Preamble

III. Endangerment and Cause or Contribute Analyses

The Administrator proposes to find that the air pollution of elevated levels of greenhouse gas (GHG) concentrations may reasonably be anticipated to endanger public welfare. The Administrator is defining the air pollution to be the elevated concentrations of the mix of six GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The Administrator further proposes to find under section 202(a) that CO_2 emissions from new motor vehicles contribute to this air pollution, and that under section 211(c)(1) CO_2 emissions from the combustion of fuels used by motor vehicles, nonroad vehicles, and nonroad engines contribute to this air pollution. As discussed further below, the Administrator is considering whether emissions of CH_4, N_2O, and HFCs under sections 202(a) and 211(c)(1) do or do not contribute to this air pollution, and intends to make a determination on this issue in the final rule.

This section is organized in the following manner. Section III.A discusses the legal framework for the endangerment and "cause or contribute" analyses. Section III.B sets forth the definition of the "air pollution" that causes endangerment, and provides the evidence and rationale for EPA's positive endangerment finding. Finally, Section III.C sets forth the Administrator's proposal regarding whether emissions of "air pollutants" from the relevant mobile sources under sections 202 and 211 of the CAA "cause or contribute" to this air pollution.

A. Legal Framework

1. Statutory Endangerment Language

Section 202(a)(1) of the Act states that

> [t]he Administrator shall by regulation prescribe (and from time to time revise) . . . standards applicable to the emissions of any air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, *which in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.*

42 U.S.C. §7521(a)(1)(emphasis added). Similarly, section 211(c)(1) of the CAA in relevant part provides that:

> [t]he Administrator may, from time to time on the basis of information obtained under subsection (b) of this section or other information available to him, by regulation, control or prohibit the manufacture, introduction into commerce, offering for sale, or sale of any fuel or fuel additive for use in a motor vehicle, motor vehicle engine, or nonroad engine or nonroad vehicle (A) *if in the judgment of the Administrator* any emission product of such fuel or fuel additive *causes, or contributes, to air pollution which may reasonably be anticipated to endanger the public health or welfare. . . .*

42 U.S.C. §7545(c)(emphasis added). This language establishes a two part test, both parts of which must be satisfied before the Administrator is authorized to take certain regulatory actions under section 202(a) or section 211(c)(1) to address GHG emissions from new motor vehicles or engines or motor vehicle or nonroad fuels. First the Administrator must decide if, in his judgment, air pollution -- here the elevated concentration of six GHGs in the atmosphere -- may reasonably be anticipated to endanger public health or welfare. Second, the Administrator must decide whether, in his judgment, emissions of GHGs from new motor vehicles or engines, or the emission products of fuel or fuel additives used in motor vehicles and nonroad vehicles and engines, cause or contribute to this air pollution.

2. Origin of Current Endangerment and Cause or Contribute Language

As part of the 1977 amendments to the Clean Air Act, Congress revised prior endangerment language in sections 202(a)(1) and 211(c) to the versions in the current Act. The legislative history provides important information regarding Congress= intent when it revised this language. In particular, the House Report by the Committee on Interstate and Foreign Commerce provides a long discussion on the amendments. *See* H.R. Rep. 95-294 (1977), *as reprinted in* 4 A Legislative History of the Clean Air Act Amendments of 1977 at 2465 (hereinafter "LH").

a. *Ethyl Corp. v. EPA*

As noted in the legislative history, Congress relied heavily on the approach discussed in a D.C. Circuit opinion interpreting the pre-1977 version of section 211. In *Ethyl Corp v. EPA*, 541 F.2d 1 (D.C. Cir. 1976), the en banc court reversed a panel decision regarding an EPA rule restricting the content of lead in leaded gasoline.[1] The en banc court opened its opinion by stating the context for its decision:

> Man=s ability to alter his environment has developed far more rapidly than his ability to foresee with certainty the effects of his alterations.

541 F.2d at 6. After reviewing the facts, statute, proceedings and regulations, the full-court then went on to evaluate the statutory language at issue to see what level of Acertainty [was] required by the Clean Air Act before EPA may act.@ *Id*.

The 3-judge panel had held that the language Awill endanger@ required proof of actual harm, and that the actual harm had to come from fuels Ain and of themselves.@ *Id*. at 12. The en banc

1 At the time of the 1973 rules requiring the reduction of lead in gasoline, section 211(c)(1)(A) of the CAA stated that the Administrator may promulgate regulations that

> control or prohibit the manufacture, introduction into commerce, offering for sale, or sale of any fuel or fuel additive for use in a motor vehicle o motor vehicle engine (A) if any emissions product of such fuel or fuel additive *will endanger the public health or welfare . . . .*

CAA 211(c)(1)(A) (1970) (emphasis added). The italicized language in the above quote is the relevant language revised by the 1977 amendments.

court rejected this approach, finding that the term Aendanger@ allowed the Administrator to act when harm is threatened, and did not require proof of actual harm. *Id*. at 13. AA statute allowing for regulation in the face of danger is, necessarily, a precautionary statute.@ *Id*. Optimally, the court held, regulatory action would not only precede, but prevent, a perceived threat. *Id*.

The court also rejected petitioners= argument that any threatened harm must be Aprobable@ before regulation was authorized. Specifically, the court recognized that danger Ais set not by a fixed probability of harm, but rather is composed of reciprocal elements of risk and harm, or probability or severity.@ *Id*. at 18. Next, the court held that EPA=s evaluation of risk is necessarily an exercise of judgment, and that the statute did not require a factual finding. *Id*. at 24. Thus, ultimately, the Administrator must Aact, in part on >factual issues,= but largely >on choices of policy, on an assessment of risks, [and] on predictions dealing with matters on the frontiers of scientific knowledge . . . .@ *Id*. at 29 (citations omitted). Finally, the en banc court agreed with EPA that even without the language in section 202 regarding Acause or contribute to,@ section 211 authorized EPA to consider the cumulative impact of lead from numerous sources, not just the fuels being regulated under section 211. *Id*. at 29-31.

b. The 1977 Clean Air Act amendments

It is against this backdrop that Congress amended the CAA in 1977. The dissent in the original *Ethyl Corp* decision and the en banc opinion were of Acritical importance@ to the House subcommittee and Committee which proposed the revisions to the endangerment language in the CAA. H.R. Rep. 95-294 at 48, 4 LH at 2515. In particular, the Committee believed the *Ethyl Corp* decisions posed several Acrucial policy questions@ regarding the protection of public health and welfare. *Id*. The House Report addresses these questions in setting forth the reasons for the committee proposal that eventually became the language in sections 202 and 211 of the CAA.[2]

The Committee proposed specific language to implement several purposes consistent with the en banc decision in *Ethyl Corp*.[3] In total, the Aendangerment@ language in section 202(a)(1) now reads Awhich in his judgment cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare.@[4]

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2 The Supreme Court recognized that the current language in section 202(a)(1) is Amore-protective@ than the 1970 version that was similar to the section 211 language before the D.C. Circuit in *Ethyl Corp*. 127 S.Ct. at 1447, fn 1.

3 Specifically, the language (1) emphasizes the precautionary or preventive purpose of the CAA; (2) authorizes the Administrator to reasonably project into the future and weigh risks; (3) requires the consideration of the cumulative impact of all sources; (4) instructs that the health of susceptible individuals, as well as healthy adults, should be part of the analysis; and (5) indicates an awareness of the uncertainties and limitations in information available to the Administrator. H.R. Rep. 95-294 at 49-50, 4 LH at 2516-17. Congress also wanted to standardize this language across the various sections of the CAA which address emissions from both stationary and mobile sources which may reasonably be anticipated to endanger public health or welfare. H.R. Rep. 95-294 at 50, 4 LH at 2517; Section 401 of CAA Amendments of 1977.

4 The language in section 211(c)(1)(A) is slightly different: Aif in the judgment of the Administrator any emission product of such fuel or fuel additive causes, or contributes, to air pollution which may reasonably be anticipated to endanger the public health or welfare,. . .@

First, the phrases Ain his judgment@ and Ain the judgment of the Administrator@ call for the Administrator to make comparative assessment of risks and projections of future possibilities, consider uncertainties, and extrapolate from limited data. Thus, the Administrator must balance the likelihood of effects with the severity of the effects in reaching his judgment. The Committee emphasized that Ajudgment@ is different from a factual Afinding.@ Importantly, projections, assessments and estimates must be reasonable, and cannot be based on a A>crystal ball= inquiry." Moreover, procedural safeguards apply (e.g., CAA 307(d)) to the exercise of judgment, and final decisions are subject to judicial review. Last, the phrase Ain his judgment@ modifies both phrases Acause and contribute@ and Amay reasonably be anticipated@ discussed below. H.R. Rep. 95-294 at 50-51, 4 LH at 2517-18.

Second, the phrase Amay reasonably be anticipated@ builds upon the precautionary and preventative goals already provided in the use of the term Aendanger.@ Thus, it is the Administrator=s duty to assess current and future risks rather than wait for proof of actual harm. This phrase is also intended to instruct the Administrator to consider the limitations and difficulties inherent in information on public health and welfare. H.R. Rep. 95-294 at 51, 4 LH at 2518.

Finally, the phrase Acause or contribute@ ensures that all sources of the contaminant which contribute to air pollution be considered in the endangerment analysis (e.g., not a single source or category of sources). It was also intended to require the Administrator to consider all sources of exposure to a pollutant (e.g., food, water, air) when determining risk. *Id*.

3. Additional considerations for the "cause or contribute" analysis

The statute does not define the concept Acause or contribute@ and instead requires that the Administrator exercise his judgment when determining whether emissions of air pollutants cause or contribute to air pollution. Thus, the statute is ambiguous as Congress did not provide a clear, bright line test for determining whether the contribution test has been met under the varying circumstances that might arise. Instead, the Administrator has the discretion to interpret Acause or contribute@ in a reasonable manner when applying it to the circumstances present in this case. For example, Congress did not specify that the mere fact that new motor vehicles or fuels emit some amount of a GHG (e.g., one molecule) means that these emissions Acause or contribute@ as that term is used under the CAA.[5]

The D.C. Circuit has discussed the concept of Acontribution@ in the context of a CAA section 213 rule for nonroad vehicles. In *Bluewater Network v. EPA*, 370 F.3d 1 (2004), industry argued that section 213(a)(3) required a finding of a significant contribution before EPA could regulate,

[5] Moreover, even if the statute were unambiguous, the courts have recognized that Athe law does not concern itself with trifling matters@ and thus allows an agency to create exemptions based on de minimis rationale. *Alabama Power v Costle*, 636 F.2d 323, 360 (D.C. Cir. 1979). As noted above, however, the statute is ambiguous and the Administrator has greater discretion when analyzing whether emissions of air pollutants Acause or contribute@ to air pollution.

but EPA argued that the CAA required a finding only of Acontribution.@[6] *Id*. at 13. The court looked at the Aordinary meaning of >contribute=@ when upholding EPA's reading. After referencing dictionary definitions of contribute,[7] the court also noted that A[s]tanding alone, the term has no inherent connotation as to the magnitude or importance of the relevant >share= in the effect; certainly it does not incorporate any >significance= requirement.@ *Id*. The court found relevant the fact that section 213(a) uses the termAsignificant contributor@ in some places, and the term Acontribute@ elsewhere. *Id*. at 14 (AThe repeated use of the term >significant= to modify the contribution required for all nonroad vehicles, coupled with the omission of this modifier from the >cause, or contribute to= finding required for individual categories of new nonroad vehicles, indicates that Congress did not intend to require a finding of >significant contribution= for individual vehicle categories.@). The decision supports EPA's position that sections 202(a) and 211(c)(1) are ambiguous in that they do not contain any "inherent connotation as to the magnitude or importance of the relevant 'share'" and instead provide that the Administrator is to exercise his judgment. Thus, looking at the totality of the circumstances, the Administrator must exercise his judgment in a reasonable manner when making a contribution determination under these sections.

In the past, the Administrator has looked at emissions of air pollutants in various ways to determine whether they Acause or contribute@ to the relevant air pollution. For instance, in some mobile source rulemakings, the Administrator has looked at the percent of emissions from the regulated mobile source category compared to the total mobile source inventory for that air pollutant. *See, e.g.,* 66 Fed. Reg. 5001 (2001) (heavy duty engine and diesel sulfur rule). In other instances the Administrator has looked at the percent of emissions compared to the total nonattainment area inventory of the air pollution at issue. *See, e.g.*, 67 Fed. Reg. 68,242 (2002) (snowmobile rule). EPA has found that levels of air pollutant emissions at amounts as low as 1.2 percent Acontribute.@ *Bluewater Network*, 370 F.3d at 15 (AFor Fairbanks, this contribution was equivalent to 1.2% of the total daily CO inventory for 2001.@).

While these prior precedents are instructive, they also do not establish bright line emission levels above which a contribution finding must be made, or below which a contribution may not be made. Where appropriate, the Administrator may determine that emissions at a certain level or percentage contribute to air pollution in one instance, while also finding that the same level or

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[6] The relevant language in section 213(a)(3) reads A[i]f the Administrator makes an affirmative determination under paragraph (2) the Administrator shall, . . . promulgate (and from time to time revise) regulations containing standards applicable to emissions from those classes or categories of new nonroad engines and new nonroad vehicles (other than locomotives or engines used in locomotives) which in the Administrator's judgment cause, or contribute to, such air pollution.@ Notably, CAA section 213(a)(2), which is referenced in section 213(a)(3), requires that the AAdministrator shall determine . . . whether emissions of carbon monoxide, oxides of nitrogen, and volatile organic compounds from new and existing nonroad engines or nonroad vehicles (other than locomotives or engines used in locomotives) are *significant contributors* to ozone or carbon monoxide concentrations in more than 1 area which has failed to attain the national ambient air quality standards for ozone or carbon monoxide.@ (Emphasis added).

[7] Specifically, the decision noted that "=contribute= means simply >to have a share in any act or effect,= WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 496 (1993), or >to have a part or share in producing,= 3 OXFORD ENGLISH DICTIONARY 849 (2d ed. 1989).@ 370 F.3d at 13.

percentage of another air pollutant and involving different air pollution, and different overall circumstances, does not contribute. When exercising his judgment, the Administrator not only considers the cumulative impact, but also looks at the totality of the circumstances (e.g., the air pollutant, the air pollution, the type of source category, the number of sources in the source category, the number and type of other source categories that may emit the air pollutant) when determining whether the emissions Ajustify regulation@ under the CAA. *See Ethyl Corp.*, 541 F.2d at 31, n62 (AMoreover, even under a cumulative impact theory emissions must make more than a minimal contribution to total exposure in order to justify regulation under § 211(c)(1)(A).@).

B. Is Air Pollution Reasonably Anticipated to Endanger Public Health or Welfare?

1. What Is The Air Pollution?

For purposes of the endangerment finding and this rulemaking, the Administrator has determined that the "air pollution" is the elevated combined or mixed atmospheric concentration of six GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

a. Why elevated concentrations of these GHGs are the air pollution

Greenhouse gases trap in the Earth's heat that would otherwise escape to space. The additional heating effect caused by the buildup of GHGs in the atmosphere enhances the Earth's natural greenhouse effect and causes global temperatures to increase, with associated climatic changes (e.g., change in precipitation patterns, rise in sea levels, change in frequency and intensity of extreme weather events). It is the elevation in concentration and the resulting impact on climate and climate-sensitive systems that is the cause for concern.

These six GHGs can remain in the atmosphere for decades to centuries. Therefore, these GHGs, once emitted, become well mixed in the global atmosphere regardless of their emission origin, such that their concentrations over the U.S. are, for all practical purposes, the same as the global average. This also means that current GHG concentrations are the cumulative result of both historic and current emissions, and that future concentrations will be the cumulative result of historic, current and future emissions.

As discussed further below, current atmospheric concentrations of all of these GHGs are significantly higher than pre-industrial (~1750) levels as a result of human activities. Future projections show that, for most scenarios assuming no additional GHG emission reduction policies, atmospheric concentrations of these GHGs are expected to continue climbing for most if not all of the remainder of this century.

b. Why the "air pollution" is the combined mix of these six GHGs

There are a number of scientific, legal and policy reasons why EPA is determining that the air pollution for the endangerment finding and this rulemaking is the elevated combined current and projected atmospheric concentration of the six GHGs.

i. The six GHGs

Carbon dioxide is the most important GHG directly emitted by human activities, and is the most significant driver of climate change.. The anthropogenic combined heating effect (referred to as forcing) of CH_4, N_2O, HFCs, PFCs and SF_6 is about 40% as large as the CO_2 heating effect according to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). The IPCC focuses on these six GHGs for both scientific assessments and emissions inventory purposes because these are the six long-lived, well-mixed GHGs not controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer.

The President's Executive Orders 13423 and 13432 issued in 2007 also define GHGs to include the same six GHGs being considered here (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6).

There are other GHGs and aerosols that have warming effects but are not being included in the definition of "air pollution" for purposes of the endangerment finding and this rulemaking. These include water vapor, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, tropospheric ozone (O_3), and black carbon. There are different scientific and policy reasons why these substances are not being included in the definition of air pollution.

Water vapor is the most abundant naturally occurring GHG and therefore makes up a significant share of the natural, background greenhouse effect. However, water vapor emissions from human activities have only a negligible effect on atmospheric concentrations of water vapor. It follows that no emission control measures could significantly and directly affect atmospheric concentrations of water vapor. Significant changes to global atmospheric concentrations of water vapor occur indirectly through human-induced global warming, which then increases the amount of water vapor in the atmosphere because a warmer atmosphere can hold more moisture. Therefore, changes in water vapor concentrations are not an initial driver of climate change, but rather an effect of climate change which then acts as a positive feedback that further enhances warming. For this reason, the IPCC does not list direct emissions of water vapor as an anthropogenic forcing agent of climate change, but does include this water vapor feedback mechanism in response to human-induced warming in all modeling scenarios of future climate change. Based on this recognition that anthropogenic emissions of water vapor are not a significant contributor to anthropogenic climate change, EPA's annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks* does not include water vapor, and GHG inventory reporting guidelines under the United Nations Framework Convention on Climate Change (UNFCCC) do not require data on water vapor emissions.

The CFCs, HCFCs and halons are all strong anthropogenic GHGs that are long-lived in the atmosphere, and are contributing to the global anthropogenic heating effect. Therefore, these gases share common climatic properties with the six GHGs included in EPA's definition of "air pollution" for purposes of this rulemaking. However, EPA is not including CFCs, HCFCs and halons in this definition of "air pollution" for policy reasons. The production and consumption of these substances (and hence the anthropogenic emissions) are being controlled and *phased out*, not because they contribute to climate change, but due to their stratospheric ozone-depleting properties. The control and phase-out of these substances in the U.S. and globally is occurring

under Title VI of the CAA and the Montreal Protocol on Substances that Deplete the Ozone Layer[8]. Therefore, the climate change research and policy community typically does not focus on these substances, precisely because they are essentially already being 'taken care of' with non-climate policy mechanisms. For example, the UNFCCC does not address these substances, and instead defers their treatment to the Montreal Protocol. And as mentioned above, the President's Executive Orders 13423 and 13432 do not include these substances in the definition of GHGs.

Increased concentrations of tropospheric O_3 are causing a significant anthropogenic warming effect, but, unlike the long-lived six GHGs, tropospheric O_3 has a short atmospheric lifetime (hours to weeks) and therefore its concentrations are more variable over space and time. For these reasons, its global heating effect and contribution to climate change tends to entail greater uncertainty compared to the well-mixed, long-lived GHGs. More importantly, tropospheric ozone is already listed as a criteria air pollutant under the CAA, due to its direct health effects including increases in respiratory infection, medicine use by asthmatics, emergency department visits and hospital admissions, and its potential to contribute to premature death in people with heart and lung disease. Due to its designation as a criteria air pollutant, EPA issues National Ambient Air Quality Standards (NAAQS) for tropospheric ozone to protect public health and welfare, including the health of sensitive populations such as asthmatics, children and the elderly. Therefore, EPA is not including tropospheric ozone in the definition of "air pollution" for purposes of this rulemaking because, as with CFCs, HCFCs and halons, it is already being addressed by regulatory actions that control precursor emissions (nitrogen oxoides (NOx) and volatile organic compounds (VOCs)) from all major U.S. sources. The climate change research and policy community has also traditionally not focused on tropospheric ozone due to its different climate properties compared to the long-lived GHGs, and because tropospheric ozone has been the subject of local and regional air quality policies. Tropospheric ozone is not addressed under the UNFCCC.

Black carbon is an aerosol particle that results from incomplete combustion of the carbon contained in fossil fuels, and remains in the atmosphere for only about a week. Black carbon causes a warming effect by absorbing incoming sunlight (whereas GHGs cause warming by trapping outgoing, infrared heat), and by darkening bright surfaces such as snow and ice, which reduces reflectivity. Like other aerosols, black carbon can also affect the properties of clouds, which in turn can have an additional climate effect by altering the reflectivity and lifetime of clouds. How black carbon and other aerosols alter cloud properties is a key source of uncertainty in climate change science. Given these reasons, there is considerably more uncertainty associated with black carbon's warming effect compared to the estimated warming effect of the six long-lived GHGs. Black carbon is also co-emitted with organic carbon, which tends to have a cooling effect on climate because it reflects and scatters incoming sunlight. The ratio of black carbon to organic carbon varies by fuel type and by combustion efficiency. The net effect of

[8] Under the Montreal Protocol, production and consumption of CFCs were phased out in developed countries in 1996 (with some essential use exemptions) and are scheduled for phase-out by 2010 in developing countries (with some essential use exemptions). For halons the schedule was 1994 for phase out in developed countries and 2010 for developing countries; HCFC production was frozen in 2004 in developed countries, and in 2016 production will be frozen in developing countries; and HCFC consumption phase-out dates are 2030 for developed countries and 2040 in developing countries.

black carbon and organic carbon on climate should therefore be considered. Also, black carbon is a subcomponent of particulate matter (PM), which is regulated as a criteria air pollutant under the CAA due to its direct health effects caused by inhalation. Diesel vehicles are estimated to be the largest source of black carbon in the U.S., but these emissions are expected to decline substantially over the coming decades due to recently EPA promulgated regulations targeting $PM_{2.5}$ emissions from on-road and off-road diesel vehicles (the Highway Diesel Rule and the Clean Air Nonroad Diesel Rule). In sum, because black carbon has different climate properties compared to long-lived GHGs, and because major U.S. sources of black carbon are already being addressed through regulatory actions due to health concerns, EPA is not including black carbon in the definition of "air pollution" for purposes of this rulemaking.

ii. The combined mix of six GHGs

The scientific literature that assesses the potential risks and end-point impacts of climate change (driven by the accumulation of atmospheric concentrations of GHGs) does not assess these impacts on a gas-by-gas basis. Observed climate change and associated effects are driven by the buildup of all GHGs in the atmosphere, as well as other natural and anthropogenic factors that influence the Earth's energy balance. Moreover, due to the cumulative purpose of the statutory language, even if the Administrator were to look at the concentration of each GHG individually, he would most likely still have to consider the impact of the concentration of a single GHG in combination with that caused by the other GHGs.. Likewise, future projections of climate change are driven by emission scenarios of all six GHGs, as well as other already regulated pollutants.

Treating the air pollution as the elevated combined current and projected atmospheric concentration of the six GHGs is consistent with other provisions of the CAA and previous EPA practice under the CAA, where separate air pollutants from different sources but with common properties may be treated as a class (e.g., Class I and Class II substances under Title VI). This approach addresses the cumulative effect that the elevated concentrations of the six GHGs have on climate, and thus on different elements of health, society and the environment.

2. Science Summary

The following provides a summary of the underlying science that was reviewed and utilized in [ADD REFERENCES], as well as other key scientific findings from [ADD REFERENCES], utilized in support of this rulemaking.

a. Summary of key findings

i. Observed global effects

The global atmospheric CO_2 concentration has increased about 35% from pre-industrial levels to 2005, and almost all of the increase is due to anthropogenic emissions. The global atmospheric concentration of CH_4 has increased by 148% since pre-industrial levels. Current atmospheric concentrations of CO_2 and CH_4 far exceed the recorded natural range of the last 650,000 years. The N_2O concentration has increased 18%. The observed concentration increase in these non-

CO_2 gases can also be attributed primarily to anthropogenic emissions. The industrial fluorinated gases, HFCs, PFCs, and SF_6, have relatively low atmospheric concentrations but are increasing rapidly; these gases are entirely anthropogenic in origin.

The global average net effect of the increase in atmospheric GHG concentrations, plus other human activities (e.g., land use change and aerosol emissions), on the global energy balance since 1750 has been one of warming. This total net radiative forcing (a measure of the heating effect caused by changing the Earth's energy balance) is estimated to be +1.6 Watts per square meter (W/m^2). The combined radiative forcing due to the cumulative (i.e., 1750 to 2005) increase in atmospheric concentrations of CO_2, CH_4, and N_2O is +2.30 W/m^2. The rate of increase in positive radiative forcing due to these three GHGs during the industrial era is very likely to have been unprecedented in more than 10,000 years. The positive radiative forcing due to CO_2 is the largest (+1.66 W/m^2). Methane is the second largest source of positive radiative forcing (+0.48 W/m^2). Nitrous oxide has a positive radiative forcing of +0.16 W/m^2.

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level. Global mean surface temperatures have risen by 0.74°C (1.3ºF) over the last 100 years. The rate of warming over the last 50 years is almost double that over the last 100 years. Global mean surface temperature was higher during the last few decades of the 20th century than during any comparable period during the preceding four centuries.

Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations. Global observed temperatures over the last century can be reproduced only when model simulations include both natural and anthropogenic forcings, i.e., simulations that remove anthropogenic forcings are unable to reproduce observed temperature changes. Thus, the warming cannot be explained by natural variability alone.

Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases. Observations show that changes are occurring in the amount, intensity, frequency and type of precipitation. There is strong evidence that global sea level gradually rose in the 20th century and is currently rising at an increased rate. Widespread changes in extreme temperatures have been observed in the last 50 years. Globally, cold days, cold nights, and frost have become less frequent, while hot days, hot nights, and heat waves have become more frequent.

The [ADD REFERENCES] provide evidence that the U.S. and the rest of the world are experiencing effects from climate change now. Current ambient concentrations of CO_2 and other GHGs, however, remain well below published thresholds for any direct adverse health effects, such as respiratory or toxic effects.

ii. Observed U.S. effects

U.S. temperatures also warmed during the 20th and into the 21st century. U.S. temperatures are now approximately 1.0ºF warmer than at the start of the 20th century, with an increased rate of

warming over the past 30 years. The past nine years have all been among the 25 warmest years on record for the contiguous U.S., a streak which is unprecedented in the historical record. Like the average global temperature increase, the observed temperature increase for North America has been attributed to the global buildup of anthropogenic GHG concentrations in the atmosphere.

Total annual precipitation has increased over the U.S. on average over the last century (about 6%), and there is evidence of an increase in heavy precipitation events. Nearly all of the Atlantic Ocean shows sea level rise during the past decade with highest rate in areas that include the U.S. east coast.

ii. Projected effects

The [ADD REFERENCES], IPCC Fourth Assessment Report, as well as a recent report under the U.S. Climate Change Science Program, also provide projections of future ambient concentrations of GHGs, future climate change, and future anticipated effects from climate change under various scenarios. This section summarizes some of the key global projections, as well as those particular to North America and the United States. Projections for global temperature change are discussed because changes in global temperature are projected to cause effects in the United States.

Overall risk increases with increases in both the rate and magnitude of climate change. Climate warming may increase the possibility of large, abrupt, and worrisome regional or global climatic events (e.g., disintegration of the Greenland Ice Sheet or collapse of the West Antarctic Ice Sheet). The majority of the impacts literature assesses the effects of warming for climate sensitivities within the most likely range, not at the tails of the distribution. Consideration of possible extreme outcomes is crucial for risk-management analysis even if potential impacts are of low probability or low confidence.

(1) Global Effects

The majority of future reference-case scenarios (assuming no explicit GHG mitigation actions beyond those already enacted) project an increase of global GHG emissions over the century, with climbing GHG concentrations. However, projected ambient concentrations of CO_2 and other GHGs remain well below published thresholds for any direct adverse health effects, i.e., asphyxiation from direct inhalation.

Through about 2030, the global warming rate is affected little by different future scenario assumptions or different model sensitivities, i.e., there is already some degree of commitment to future warming given past and present GHG emissions. By mid-century, the choice of scenario becomes more important for the magnitude of the projected warming because only about a third of that warming is projected to be due to climate change that is already committed. By the end of the century, projected average global warming (compared to average temperature around

1990) varies significantly by emissions scenario, ranging from 1.8 to 4.0°C (3.2 to 7.2°F), with an uncertainty range of 1.1 to 6.4°C (2.0 to 11.5°F), according to the IPCC.[9]

The IPCC identifies the most vulnerable world regions as the Arctic, because of high rates of projected warming on natural systems; Africa, especially the sub-Saharan region, because of current low adaptive capacity as well as climate change; small islands, due to high exposure of population and infrastructure to risk of sea-level rise and increased storm surge; and Asian mega deltas, due to large populations and high exposure to sea level rise, storm surge and river flooding. Climate change impacts in certain regions of the world may exacerbate problems that raise humanitarian and national security issues for the U.S. Climate change has been described as a potential threat multiplier regarding national security issues.

(2) United States Effects

Projected global warming is anticipated to lead to effects in the U.S. For instance, all of the U.S. is very likely to warm during this century, and most areas of the U.S. are expected to warm by more than the global average. The U.S, along with the rest of the world, is projected to see an increase in the intensity of precipitation events and the risk of flooding, greater runoff and erosion, and thus the potential for adverse water quality effects.

Severe heat waves are projected to intensify in magnitude, frequency and duration over the portions of the U.S. where these events already occur, with likely increases in mortality and morbidity, especially among the elderly, young and frail. Warmer temperatures can lead to fewer cold-related deaths. It is currently not possible to quantify the balance between decreased cold-related deaths and increased heat-related deaths attributable to climate change over time.

The IPCC projects with virtual certainty (e.g., greater than 99% likelihood) declining air quality in cities due to warmer and fewer cold days and nights and/or warmer/more frequent hot days and nights over most land areas, including the U.S. Climate change is expected to lead to increases in regional ozone pollution, with associated risks in respiratory infection, aggravation of asthma, and potential premature death in people with heart and lung disease. Climate change effects on ambient PM is currently less certain.

Additional human health concerns include a change in the range of vector-borne diseases, and a likely trend towards more intense hurricanes (even though a singular hurricane event cannot be attributed to climate change) and other extreme weather events. For many of these issues, particular populations, such as the elderly, young, asthmatics, the frail and the poor, are most vulnerable.

Moderate climate change in the early decades of the century is projected to increase aggregate yields of rainfed agriculture in the United States by 5-20%, but with important variability among regions. However, major challenges are projected for crops that are near the warm end of their suitable range or depend on highly utilized water resources. How climatic variability and

[9] The IPCC scenarios are also described in the [ADD REFERENCES] and include a range of future global emission scenarios and a range of climate sensitivities (which measure how much global warming occurs for a given increase in global CO_2 concentrations).

extreme weather events will continue to change under a changing climate is a key uncertainty, and these events also have the potential to offset the benefits of CO_2 fertilization and a longer growing season.
Disturbances like wildfire and insect outbreaks are increasing and are likely to intensify in a warmer future with drier soils and longer growing seasons. Overall forest growth in U.S. will likely increase modestly (10-20%) as a result of extended growing seasons and elevated CO_2 over the next century, but with important spatial and temporal variation. Although recent climate trends have increased vegetation growth in parts of the United States, continuing increases in disturbances are likely to limit carbon storage, facilitate invasive species, and disrupt ecosystem services.

Climate change is projected to constrain over-allocated water resources in the U.S., increasing competition among agricultural, municipal, industrial, and ecological uses. Rising temperatures will diminish snowpack and increase evaporation, affecting seasonal availability of water.

The U.S. will be affected by global sea level rise, which is expected to increase between 0.18 and 0.59 meters relative to around 1990. These numbers represent the lowest and highest projections of the 5 to 95% ranges for all scenarios considered collectively and include neither uncertainty in carbon cycle feedbacks nor rapid dynamical changes in ice sheet flow. U.S. coastal communities and habitats will be increasingly stressed by climate change interacting with development and pollution. Sea level is already rising along much of the coast, and the rate of change will increase in the future, exacerbating the impacts of progressive inundation, storm-surge flooding, and shoreline erosion.

Climate change is likely to affect U.S. energy use (e.g., heating and cooling requirements), and energy production (e.g., effects on hydropower), physical infrastructures and institutional infrastructures. Climate change will likely interact with and possibly exacerbate ongoing environmental change and environmental pressures in settlements, particularly in Alaska where indigenous communities are facing major environmental and cultural impacts.

3. Endangerment Analysis and Finding

Based on the information before the Administrator, the Administrator proposes to find that, in his judgment, the elevated combined atmospheric concentrations of the six GHGs are reasonably anticipated to endanger public welfare. As discussed in more detail below, the scientific evidence regarding changes to the environment and changes to the climate that result from elevated levels of GHG concentrations supports this proposed finding.

A finding of endangerment to public welfare satisfies the criteria in sections 202 and 211 for a determination that the air pollution is reasonably anticipated to endanger "public health or welfare." (emphasis supplied).[10] Whether the Administrator's final endangerment finding is based on endangerment to public health or on endangerment to public welfare does not change the proposed standards contained in either the EPA Fuels Proposal or in the EPA Vehicles Proposal because EPA is considering all the benefits from reduced GHG emissions in its

[10] The "cause or contribute" element of the endangerment finding is discussed in section III.B. below.

analyses. Thus, at this time the Administrator does not need to and is not addressing whether elevated levels of GHG concentrations may reasonably be anticipated to endanger public health.

a. Legal context

As discussed above, the Administrator must exercise his judgment in evaluating whether the endangerment criteria are met. In exercising his judgment it is appropriate for the Administrator to make comparative assessments of risk and projections of future possibilities, consider uncertainties, and extrapolate from limited data. The precautionary nature of the statutory language also means that the Administrator should act to prevent harm rather than wait for proof of actual harm.

b. Administrator's reasoning

The Administrator believes that there is compelling and robust evidence that observed climate change can be attributed to the heating effect caused by global anthropogenic GHG emissions. The evidence goes beyond increases in global average temperature to include observed changes in precipitation patterns, sea level rise, extreme hot and cold days, sea ice, glaciers, ecosystem functioning and wildlife patterns. Recent global warming trends stand out as significant compared to estimated global average temperatures for at least the last few centuries. The experts agree that some degree of future warming is now unavoidable given the current buildup of atmospheric concentrations of GHGs, as the result of past and present GHG emissions. Based on the evidence before him, the Administrator believes it is reasonable to conclude current and future emissions of GHGs will contribute to future climate change. Future warming over the course of the 21st century, even under scenarios of low emissions growth, is very likely to be greater than observed warming over the past century.

The Administrator is aware that the range of potential impacts that can result from climate change spans many elements of the global environment, and that all regions of the U.S. will be affected in some way. The U.S. has a long and populous coastline. Sea level rise will continue and exacerbate storm-surge flooding and shoreline erosion. In areas where heat waves already occur, they are expected to become more intense, more frequent, and longer lasting. Wildfires and the wildfire season are already increasing and climate change is expected to continue to worsen conditions that facilitate wildfires. Where water resources are already scarce and over-allocated in the western U.S., climate change is expected to put additional strain on these water management issues for municipal, agricultural, energy and industrial uses. Climate change also introduces an additional stress on ecosystems which are already affected by development, habitat fragmentation, and broken ecological dynamics. The Administrator is also aware that there is a wide range in the magnitude of these estimated impacts, with there being more confidence in the occurrence of some effects and less confidence in the occurrence of other effects.

In addition to the effects from changes in climate, there are some additional welfare effects that occur directly from the anthropogenic GHG emissions themselves. For example, ocean acidification occurs through elevated concentrations of CO_2, and crop and other vegetation growth can be enhanced through elevated CO_2 concentrations as well.

The Administrator is proposing that elevated concentrations of the GHGs are reasonably anticipated to endanger public welfare, given the stated vulnerabilities, risks and impacts from climate change on air quality (and related effects on the environment from the changes in air quality), agriculture, forestry, water resources, ecosystems, coastal areas, the energy sector, infrastructure and settlements, and the direct effects of such elevated concentrations on the environment.

Current and projected levels of ambient concentrations of the six GHGs are not expected to cause any direct adverse health effects, such as respiratory or toxic effects. However, there are human health risks and benefits associated with climate change. It is not clear how these impacts should be characterized under the Clean Air Act for purposes of an endangerment analysis, however, which defines "welfare" as including weather, climate and other effects. For this reason the Administrator is not proposing a separate endangerment finding for public health at this time. As noted above, the Administrator needs to find only that elevated levels of GHG concentrations may reasonably be anticipated to endanger public health *or* welfare, and the proposed finding for public welfare meets this statutory hurdle.

Some elements of human health, society and the environment may benefit from climate change, but the potential for some benefits does not undermine the positive endangerment finding, which is based on the full weight of evidence showing numerous risks and the potential for adverse impacts.

Quantifying the exact nature and timing of impacts due to climate change over the next few decades and beyond across all vulnerable elements of U.S. health, society and the environment is currently not possible. The Administrator acknowledges these uncertainties but does not view these uncertainties as being "so profound" that they preclude the Administrator "from making a reasoned judgment." 127 S.Ct. at 1463. First, the full weight of evidence as summarized above and in the [ADD REFERENCES] points towards the robust conclusion that expected rates of climate change (driven by past, present and plausible future GHG emissions) pose a number of serious risks to the U.S., even if the exact nature of the risks are difficult to quantify with confidence. Second, the uncertainties in this context can also mean that future rates of climate change are being underestimated, and that the potential for associated and difficult-to-predict-and-quantify extreme events are not adequately incorporated into impact assessments. The scientific literature states that risk increases with increases in both the rate and magnitude of climate change.

In light of the precautionary nature of the statutory language, the Administrator does not need to find that current levels of GHG concentrations endanger public welfare now. As noted above, the fact that GHGs remain in the atmosphere for decades to centuries means that future concentrations are dependent not only on tomorrow's emissions, but also on today's emissions. The Administrator has considered both current and projected future elevated concentrations of GHGs, as well as the totality of the observed and projected effects that result from current and projected concentrations. The Administrator focused on future projected elevated concentrations of GHGs and their projected effects in the United States because they are larger and of greater concern than current GHG concentrations and observed effects. Out of concern for the future

effects -- and considering uncertainties, comparing risks and extrapolating from available data -- the Administrator is proposing that projected elevated concentrations of GHGs (due to historic, current and projected emissions) are reasonably anticipated to endanger public welfare.

In sum, the Administrator is proposing to find that elevated levels of GHG concentrations may reasonably be anticipated to endanger public welfare. At this time, the Administrator is not addressing whether there is such endangerment for public health. We note that some take the position that the Agency should not find endangerment and the EPA takes comment on that position as well as all aspects of this endangerment analysis.

C. Do emissions of air pollutants from motor vehicles or fuels contribute to the air pollution that is reasonably anticipated to endanger public welfare in the United States?

1. What is/are the air pollutant(s)?

a. Background and context

As noted above, the Administrator has proposed to define the air pollution for purposes of the endangerment finding to be the elevated combined atmospheric concentrations of six greenhouse gases (i.e., CO_2, CH_4, N_2O, HFCs, PFCs, SF_6). The Administrator must also define "air pollutant(s)" for purposes of making the "cause or contribute" determination. The question is whether the "air pollutants" to be evaluated for "cause or contribute" should be the individual GHGs, or whether the "air pollutant" is the class of GHGs as a collective whole.

Sources covered by Sections 202 and 211 of the Clean Air Act emit four of the six greenhouse gases discussed above: CO_2, CH_4, N_2O, and HFCs. Importantly, under either approach to defining "air pollutant," the Administrator could propose the same standards under section 202 and 211 because of the flexibility the statute gives the Administrator to consider factors such as technical feasibility and cost. Of course, a finding of contribution is required before a standard for an air pollutant can be finalized.

b. Proposal to define "air pollutant" as each individual greenhouse gas

The Administrator is proposing to define "air pollutant" as each individual GHG rather than as a class of GHGs as a collective whole for the purposes of assessing "cause or contribute." Thus, the Administrator will be evaluating each individual GHG to determine if it causes, or contributes to, the elevated combined level of GHG concentrations. The Administrator is proposing this approach because it enables a more complete evaluation of the unique characteristics and properties of each GHG (e.g., radiative forcing, lifetimes, etc.), as well as current and projected emissions. This facilitates a customized approach accounting for these factors.

This approach is consistent with the approach taken in several federal GHG programs which target reductions of individual greenhouse gases. For example, EPA manages a variety of partnership programs aimed at reducing emissions of specific sources of methane and the fluorinated gases (HFCs, PFCs and SF_6). In addition, EPA currently collects CO_2 data from electric power generators regulated under Title IV of the Clean Air Act (based on the language of Section 821 of the CAA Amendments of 1990) and does not collect data on emissions of other GHGs from combustion (i.e., CH_4 and N_2O) from these sources.

We recognize that this proposed definition could have important implications for how GHGs are treated in the context of other Titles of the Clean Air Act. These implications have not been fully characterized. The Administrator seeks comment on this proposal, and is particularly interested in views regarding its implications for the potential future regulation of GHGs under other parts of the Clean Air Act.

c. Defining "air pollutants" collectively as a class of greenhouse gases

The Administrator has also considered the possibility of defining "air pollutant" collectively as a single class of greenhouse gases. Under this collective approach, the Administrator could define the "air pollutant" as either the collective group of six greenhouse gases in the definition of air pollution (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6), or the collective group of the four greenhouse gases that are emitted from Section 202/211 sources (CO_2, CH_4, N_2O, and HFCs).

There are several federal and state climate programs, such as EPA's Climate Leaders program, DOE's 1605b program, and California's Climate Action Registry, that encourage firms to report (and reduce) emissions of all 6 greenhouse gases. In addition, the President's recent 2007 Executive Orders (13423 and 13432) and his 2002-2012 intensity goal both encompass the collective emissions of all 6 greenhouse gases. A brief discussion of the emissions trends for all greenhouse gases combined are presented in parts 2g and 3f of this section.

As above, the Administrator is seeking comment on how other programs under the CAA might be affected by using this definition.

2. Discussion of contribution of greenhouse gases from 202 source categories

a. Overview of Section 202 source categories

The relevant mobile sources under section 202 (a)(1) of the Clean Air Act are "any class or classes of new motor vehicles or new motor vehicle engines, ..." CAA §202(a)(1). To support the Administrator's assessment, EPA has analyzed historical greenhouse gas emissions data for motor vehicles and motor vehicle engines in the United States from 1990 to 2005 (the most recent year for which official EPA estimates are available).

The motor vehicles and motor vehicle engines (hereinafter "Section 202 source categories") addressed are:

- Passenger cars
- Light-duty trucks
- Motorcycles
- Buses
- Medium/heavy-duty trucks
- Cooling[11]

The source of the emissions data is the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 (USEPA #430-R-07-002)* (hereinafter "U.S. Inventory"). See [ADD REFERENCES] for a discussion on the correspondence between Section 202 source categories and IPCC source categories.

11 Greenhouse gas emissions result from the use of HFCs in cooling systems designed for passenger comfort, as well as auxiliary systems for refrigeration.

There are many possible ways of assessing "cause and contribute" and no single approach has been used in previous endangerment determinations under the CAA. To support an informed assessment, we provide the following types of comparisons for emissions of each GHG from Section 202 source categories:

- As a share of total global aggregated emissions of the 6 greenhouse gases included in the definition of "air pollution";
- As a share of total aggregated U.S. emissions of these greenhouse gases;
- As a share of aggregated U.S. greenhouse gas emissions for existing motor vehicles and engines;
- As a share of global emissions of that individual greenhouse gas; and
- As a share of total U.S. emissions of that individual greenhouse gas, including comparisons to the magnitude of emissions of that gas from other non-transport related source categories.

As usual, for the "cause or contribute" evaluation, the Administrator is comparing and considering annual emissions data. Because the air pollution to which the contribution is being evaluated is the mix of six GHG concentrations, the logical starting point for any contribution analysis is a comparison of the emissions of the air pollutant from the Section 202 or 211 source category to the total, global emissions of the six GHGs. The Administrator recognizes that there are other comparisons, such as those listed above, that can be considered in the decision about whether emissions of the air pollutant causes or contributes to the elevated combined concentration of the six GHGs, and those assessments are provided within the discussions of the contributions from Section 202 and 211 source categories. The Administrator is considering all of this information, as well as various policy considerations discussed below, and proposes a decision based on the body of information before him. As discussed below, EPA invites comment on the weight that should be placed on the various information and policy considerations discussed below.

An overview of the analysis is presented here, and a more detailed description along with data tables is contained in [ADD REFERENCES]. All annual emissions data are being considered on a CO_2 equivalent basis, which is a commonly accepted metric for comparing different GHGs, both in the U.S. annual GHG Inventory and with international GHG inventories from other Parties to the UNFCCC.[12]

EPA invites comment on these and other comparisons, as well as on the data used in the analysis. For example, comparing the contribution of the flow of emissions of a particular GHG from Section 202 or Section 211 source categories to the stock of that GHG concentration in the atmosphere could provide useful insights.

12 Emissions of different greenhouse gases are compared using global warming potentials (GWPs). The GWP of a greenhouse gas is defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kilogram (kg) of a trace substance relative to that of 1 kg of a reference gas (IPCC 2001). Direct radiative effects occur when the gas itself is a greenhouse gas. The reference gas used is CO_2, and therefore GWP-weighted emissions are measured in teragrams of CO_2 equivalent (Tg CO_2 Eq.).

b. Proposal regarding the contribution of carbon dioxide emissions from Section 202 source categories to the elevated combined level of GHG concentrations

Carbon dioxide is emitted from motor vehicles and motor vehicle engines during the fossil fuel combustion process. During combustion, the carbon stored in the fuels is oxidized and emitted as CO_2 and smaller amounts of other carbon compounds.[13]

The positive radiative forcing due to carbon dioxide since pre-industrial times is the largest among the 6 GHGs which constitute the "air pollution." Carbon dioxide is indisputably the most significant GHG emitted by the transportation sector. Carbon dioxide is the dominant greenhouse gas emitted from motor vehicles and motor vehicle engines (94 percent of total U.S. Section 202 source category GHG emissions in 2005). Carbon dioxide emissions from these source categories grew by 34 percent between 1990 and 2005, largely due to increased CO_2 emissions from light-duty trucks (75 percent since 1990) and medium/heavy-duty trucks (70 percent).

Globally, in 2000, CO_2 from motor vehicles and engines in the U.S. contributed more to global aggregate greenhouse gas emissions (4.3 percent) than total national emissions of most individual countries, with the exception of the People's Republic of China and the Russian Federation.[14] This information alone could support a positive contribution proposal. However, the Administrator also looked at additional information.

In 1990, Section 202 source categories emitted just under 23 percent of total U.S. CO_2 emissions, behind the electricity generation sector (36 percent) and ahead of the industrial sector (19 percent). By 2005, Section 202 source categories collectively were again the second largest sector, growing to 26 percent of total U.S. CO_2 emissions. Section 202 CO_2 emissions are a significantly larger share of global transportation greenhouse gas emissions (29 percent) than the corresponding share of all U.S. CO_2 emissions to the global total (18 percent), reflecting the comparatively larger size of the transport sector in the U.S. compared to the global average.

Based on these data, the Administrator proposes to find that, for purposes of section 202, carbon dioxide emissions from Section 202 source categories contribute to the elevated combined level of GHG concentrations.

c. Proposal regarding the contribution of methane emissions from Section 202 source categories to the elevated combined level of GHG concentrations

Methane emissions from motor vehicles are a function of the CH_4 content of the motor fuel, the amount of hydrocarbons passing uncombusted through the engine, and any post-combustion control of hydrocarbon emissions (such as catalytic converters).

[13] Detailed carbon dioxide emissions data from Section 202 source categories are presented in Tables [ADD REFERENCES].

[14] United Nations Framework Convention on Climate Change (UNFCCC). Greenhouse Gas Inventory Data (http://unfccc.int/ghg_emissions_data/ghg_data_from_unfccc/items/4146.php).

As noted above, the Administrator reviewed first the share of emissions of methane from Section 202 source categories compared to total global GHG emissions. Methane emissions from Section 202 source categories were 0.01 percent of total global greenhouse gas emissions in 2000. When compared to the smaller subsets of global transportation emissions, and global methane emissions, Section 202 source category CH_4 emissions were 0.06 and 0.05 percent respectively in 2000.

Compared to U.S. emissions, methane emissions from Section 202 source categories were 0.12 percent of total GHG emissions from motor vehicles and motor vehicle engines in 2005. Methane emissions from these source categories decreased by 53 percent between 1990 and 2005, largely due to decreased CH_4 emissions from passenger cars (59 percent) and light-duty trucks (43 percent). In 2005, CH_4 emissions from these source categories equaled 0.37 percent of total U.S. CH_4 emissions and 0.04 percent of total U.S. GHG emissions.

Based on this information, the Administrator is proposing two findings in the alternative. First, the Administrator proposes to find that, for purposes of Section 202, methane emissions from Section 202 source categories do contribute to the elevated combined level of GHG concentrations. Alternatively, the Administrator proposes to find that they do not. As discussed below, information and policy considerations could support a final determination on either option, and thus, the Administrator is soliciting comment on both possible final determinations.[15]

In proposing a finding of non-contribution, the Administrator recognizes that Section 202 source category emissions of methane were very small percentages of the total global GHG emissions, as well as all of the other comparisons (e.g., U.S. methane emissions and U.S. GHG emissions). Section 202 methane emissions were the smallest of any of the four greenhouse gases and lower than any amount that has been found to contribute in other rulemakings. In the past, the smallest level or amount of emissions that the Administrator determined "contributed" to the air pollution at issue was just less than 1 percent [67 Fed. Reg. 68,242 (2002)]. Moreover, Section 202 source category emissions of CH_4 are on the decrease, having decreased by 53 percent between 1990 and 2005.

In proposing a finding of contribution, the Administrator notes several other factors. First, given the global nature of air pollution being addressed in this rulemaking, one might expect that percentage contribution of specific gases and sectors would be much smaller than for previous rulemakings when the nature of the air pollution was national, regional or local. On an absolute basis, for example, a small U.S. source on a global scale may have emissions at the same level as one of the largest sources in a single small to medium size country, and given the size of the denominator, even sectors with significant emissions could be very small in percentage terms.

The Administrator notes that the EPA promotes the reduction of methane and other non-CO_2 GHG emissions, as manifested in its domestic methane partnership programs and the international Methane to Markets Partnership, which was launched in 2004. The Administrator requests comment on how these and other efforts to encourage the voluntary reductions in even

15 Detailed methane emissions data for Section 202 source categories are presented in Tables [ADD REFERENCES]

small amounts of GHG emissions are relevant to decisions about what level of "contribution" merits mandatory regulations.

d. Proposal regarding the contribution of nitrous oxide emissions from Section 202 source categories to the elevated combined level of GHG concentrations

Nitrous oxide (N_2O) is a product of the reaction that occurs between nitrogen and oxygen during fuel combustion. Nitrous oxide (and nitrogen oxide (NO_X)) emissions from motor vehicles and motor vehicle engines are closely related to fuel characteristics, air-fuel mixes, combustion temperatures, and the use of pollution control equipment. For example, some types of catalytic converters installed to reduce motor vehicle NO_X, CO, and hydrocarbon emissions can promote the formation of N_2O.

Starting with global, total GHG emissions, nitrous oxide emissions from Section 202 source categories were 0.15 percent in 2000. Also in 2000, they accounted for 1.5 percent of global N_2O emissions and just less than1 percent of global transportation emissions.

Looking at U.S. GHG emissions, nitrous oxide emissions from Section 202 source categories accounted for 2.0 percent of total GHG emissions from motor vehicles and motor vehicle engines in 2005. Nitrous oxide emissions from these source categories decreased by 16 percent between 1990 and 2005, largely due to decreased emissions from passenger cars (50 percent) and light-duty trucks (46 percent). In 2005, N_2O emissions from these source categories equaled 7.2 percent of total U.S. N_2O emissions.

Based on this information, the Administrator is proposing two findings in the alternative. First, the Administrator proposes to find that, for purposes of Section 202, nitrous oxide emissions from Section 202 source categories do contribute to the elevated combined level of GHG concentrations. Alternatively, the Administrator proposes to find that they do not. As discussed below, information and policy considerations could support a final determination on either option, and thus, the Administrator is soliciting comment on both possible final determinations.[16]

In proposing a finding of non-contribution, the Administrator recognizes that the Section 202 source categories N_2O emissions in 2000 were only 0.15 percent of total global greenhouse gas emissions in 2000, and less than 1 percent of global transportation emissions. In the past, the smallest level or amount of emissions that the Administrator determined "contributed" to the air pollution at issue was just under one percent. [67 Fed. Reg. 68,242 (2002)]. Moreover, Section 202 source category emissions of N_2O are on the decrease, having decreased by 16 percent from 1990 to 2005. Earlier generation control technologies initially resulted in higher N_2O emissions, causing a 24 percent increase in N_2O emissions from motor vehicles between 1990 and 1995. Improvements in later-generation emission control technologies have reduced N_2O output, resulting in a 32 percent decrease in N_2O emissions from 1995 to 2005.

In proposing a finding of contribution, the Administrator notes that although Section 202 emissions of N_2O were small on a global basis, they were 7.2 percent of total U.S. N_2O emissions in 2005, and 1.5 percent of global N_2O emissions in 2000. In fact, Section 202 source

[16] Detailed nitrous oxide emissions data for Section 202 source categories are presented in [ADD REFERENCES].

categories were the second largest U.S source of nitrous oxide, behind only agricultural soil management (which represented 78 percent of total N_2O emissions in 2005). In addition, as mentioned in the previous discussion of methane, given the vast number of sources and sectors that emit greenhouse gases around the world, even sources which represent a small percentage of U.S. or global emissions can have large absolute emissions. Finally, past experience has shown that small nitrous oxide sources can contribute substantial emissions reductions. For example, the N_2O emissions from adipic acid production is smaller than that of Section 202 sources, and this sector reduced its emission by over 60 percent from 1990 to 2005 as a result of voluntary adoption of N_2O abatement technology by the three major U.S. adipic acid plants (U.S. GHG Inventory, 2007, p.2-16).

e. Proposal regarding the contribution of HFC emissions from Section 202 source categories to the elevated combined level of GHG concentrations

Hydrofluorocarbons (a term which encompasses a group of eleven related compounds) are progressively replacing CFCs and HCFCs in Section 202 cooling and refrigeration systems as they are being phased out under the Montreal Protocol and Title VI of the Clean Air Act.[17] For example, HFC-134a has become a replacement for CFC-12 in mobile air conditioning systems. A number of HFC blends, containing multiple compounds, have also been introduced. The emissions pathway can be complex, with HFCs being emitted to the atmosphere during charging of cooling and refrigeration systems, during operation, and during decommissioning/disposal.

In 2000, hydrofluorocarbons from Section 202 source categories were 0.15 percent of total global greenhouse gas emissions. When compared to the smaller subset of global transportation emissions, Section 202 source category HFC emissions were slightly over 1 percent in 2000. Turning to U.S. emissions, Section 202 source categories accounted for 4.0 percent of total GHG emissions from motor vehicles and motor vehicle engines in 2005. Hydrofluorocarbons were not used in motor vehicles in 1990, but by 2005 emissions had increased to 67 Tg CO_2e. In 2005, HFC emissions from these source categories equaled 48 percent of total U.S. HFC emissions, making it the single largest source category, and 19 percent of global HFC emissions.

Based on this information, the Administrator is proposing two findings in the alternative. First, the Administrator proposes to find that, for purposes of section 202, HFC emissions from Section 202 source categories do contribute to the elevated combined level of GHG concentrations. Alternatively, the Administrator proposes to find that they do not. As discussed below, information and policy considerations could support a final determination on either option, and thus, the Administrator is soliciting comment on both possible final determinations.[18]

In proposing a finding of non-contribution, the Administrator recognizes that, in 2000, HFC emissions from Section 202 source categories accounted for 0.15 percent of total global GHG emissions in 2000.[19] This percentage is much smaller than the contribution of the CO_2 emissions

[17] 2006 IPCC Guidelines, Volume 3, Chapter 7. Page 43.
[18] Detailed HFC emissions data for Section 202 source categories are presented in Tables [ADD REFERENCES].
[19] Estimates of HFC emissions included in Tables [ADD REFERENCES] include a small share of emissions resulting from sources not included under Section 202 (e.g., nonroad and agricultural vehicles). As the majority of

of Section 202 source categories. In the past, the smallest level or amount of emissions that the Administrator determined "contributed" to the air pollution at issue was just less than 1 percent. [67 Fed. Reg. 68,242 (2002)]. Even when compared to the smaller subset of global transportation emissions, Section 202 source category HFC emissions are just over 1 percent.

In co-proposing a finding of contribution, the Administrator again recognizes that when looking at a global air pollution problem, a smaller percentage from a U.S. source category may be considered to "contribute" than if the Administrator were assessing air pollution of national, regional or local concern. In addition, the Administrator notes that Section 202 HFC emissions are the largest source of HFC emissions in the United States, that these emissions increased by 250% from 1995 to 2005, and that they are also the largest source of emissions of HFCs, PFCs or SF_6. Thus, a decision not to set standards for HFCs under Section 202 could be viewed as precedential with respect to the likelihood of future regulatory actions for any of these three gases.

The Administrator recognizes that the U.S. has a long history of encouraging HFC emission reductions. The program to reduce emissions of HFC-23 associated with HCFC-22 production, for example, has been very successful and this is a much smaller emission source than Section 202 sources. The Administrator requests comment on how these and other efforts to encourage the voluntary reductions in even small amounts of GHG emissions are relevant to decisions about what level of "contribution" merits mandatory regulations.

f. PFC and SF_6 emissions are not emitted by Section 202 source categories

Perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) are not emitted from motor vehicles or motor vehicle engines in the United States.

g. Information regarding total GHG emissions from Section 202 source categories

As discussed above, the Administrator is proposing to define "air pollutant(s)" for purposes of making the Sections 202/211 contribution findings as the individual GHGs emitted by the section 202 and 211 source categories. Nonetheless, the Administrator is seeking comment on whether, instead, to make the contribution finding as to the collective whole of these emissions. Thus, the discussion in this section summarizes information in [ADD REFERENCES] on emissions of total greenhouse gases (CO_2, CH_4, N_2O, and HFCs) from Section 202 source categories.[20] The Administrator notes that if he were to define the "air pollutant" as the collective group of four to six greenhouse gases, he would likely find contribution on the basis that he is already proposing that CO_2 alone contributes. Additionally, given that total greenhouse gas emissions from Section 202 source categories are almost 5 percent of total global GHG emissions, adopting this definition of "air pollutant" would make it unnecessary to assess the individual GHG emissions levels less than that amount.

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air conditioning and cooling systems are related to road transport, the effect of this overestimate is expected to be negligible. See US Inventory (www.epa.gov/climatechange/emissions), Chapter 4.

[20] Detailed combined greenhouse gas emissions data for Section 202 source categories are presented in Tables [ADD REFERENCES]

Between 1990 and 2005, *total* greenhouse gas emissions (measured in CO_2 equivalents) from passenger cars decreased 1.6 percent, while emissions from light-duty trucks increased 72 percent, largely due to the increased use of sport-utility vehicles and other light-duty trucks. In 2005, the CO_2 made up the largest share of emissions (94 percent), followed by HFCs (4.0 percent), N_2O (2.0 percent) and CH_4 (0.12 percent). Since 1990, the share of HFCs has increased (from zero in 1990), whereas the share of the other gases has correspondingly decreased. Methane and N_2O emissions have decreased in absolute terms since 1990.

In 2005 Section 202 source categories collectively were the second largest sector with 23 percent of total U.S. emissions behind the electricity generating sector. Section 202 greenhouse gas emissions are a 31 percent share of global transport greenhouse gas emissions and 4.6 percent of total global emissions in 2000. The global transport sector was 15 percent of all global emissions in 2000.

h. Request for comment on contribution proposals

The Administrator is seeking comment on all of the above proposals regarding the contribution of carbon dioxide, methane, nitrous oxide, and HFC emissions from Section 202 source categories to the "air pollution". Specifically, the Administrator is interested in comments regarding the data and comparisons underlying the analysis contained in Annex A to the Technical Support Document. The Administrator also welcomes comment on prior precedents for assessing contributions, as well as the precedential impact of today's contribution findings for other potential sources of these and other greenhouse gases. We also welcome comment on the relationship of these proposals to existing U.S. climate change emissions reduction programs and the magnitude of reductions sought under these programs.

The Administrator is proposing standards for emissions of the non-CO_2 GHGs from section 202 source categories, conditioned on a final decision that emissions of one or more of these GHGs from Section 202 source categories do contribute to the relevant air pollution.

3. Discussion of contribution from 211 source categories

a. Overview of Section 211 source categories

Section 211 (c)(1) of the Clean Air Act, in relevant part, states that "The Administrator may . . . by regulation, control or prohibit the manufacture, introduction into commerce, offering for sale, or sale of <u>any fuel or fuel additive for use in a motor vehicle, motor vehicle engine, or nonroad engine or nonroad vehicle</u> (A) if in the judgment of the Administrator any <u>emission product of such fuel or fuel additive causes, or contributes</u>, to air pollution which may reasonably be anticipated to endanger the public health or welfare, . . ." Thus, Section 211 regulates a larger set of sources than Section 202. It also requires that the contribution finding be made for the "emissions product of such fuel or fuel additive."

As with the Section 202 analysis, EPA has analyzed historical greenhouse gas emissions resulting from fuels and fuel additives used in motor vehicles, motor vehicle engines, nonroad engines and nonroad vehicles in the United States from 1990 to 2005. The source categories

which use the fuel or fuel additives under Section 211 include the Section 202 source categories, with a few differences. HFC emissions are excluded in Section 211, because they are not an emission product of a fuel or fuel additive. Additional source categories in Section 211 are:

- Boats and ships (domestic)
- Locomotives, transit rail
- Agricultural equipment (i.e., mobile farm equipment)
- Construction equipment (i.e., mobile construction equipment)
- Other equipment (i.e., other mobile equipment not included elsewhere)

As with data provided earlier for Section 202 source categories, the source of the emissions data is the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005 (USEPA #430-R-07-002).* An overview of the analysis is presented here, and a more detailed description along with data tables is contained in [ADD REFERENCES]. All the emissions data are presented in carbon dioxide equivalents. EPA provides data to make the same comparisons as were described for the Section 202 source categories, and as for Section 202 source categories, solicits comment on the relevant comparisons, additional comparisons, and the data used for the comparisons.

b. Proposal regarding the contribution of carbon dioxide emissions from Section 211 source categories to the elevated combined level of GHG concentrations

Section 211 source category CO_2 emissions were 5.1 percent of total global emissions in 2000. Section 211 source category CO_2 emissions are a significantly larger share of global transportation greenhouse gas emissions (34 percent) than the corresponding share of all U.S. CO_2 emissions to the global total (18 percent), reflecting the relative size of the transport sector in the United States compared to the global average.

In 1990, Section 211 source categories emitted just over 27 percent of total U.S. CO_2 emissions, behind the electricity generation sector (36 percent) and ahead of the industrial sector (19 percent). By 2005, Section 211 source categories collectively remained the second largest sector with 31 percent of total U.S. CO_2 emissions.

The Administrator proposes to find that, for purposes of Section 211, carbon dioxide emissions from fuels and fuel additives used in Section 211 source categories contribute to the elevated combined level of GHG concentrations.[21] Carbon dioxide emissions from Section 211 source categories are larger than that for Section 202 source categories because they reflect emissions from Section 202 source categories as well as additional nonroad sources. Thus, if the level of CO_2 emissions from section 202 source categories is a basis for proposing to find a contribution finding, the level of emissions from Section 211 source categories must be as well.

c. Proposal regarding the contribution of methane emissions from Section 211 source categories to the elevated combined level of GHG concentrations

21 Detailed carbon dioxide emissions data from Section 211 source categories are presented in Tables [ADD REFERENCES].

Methane is emitted from Section 211 source categories via the same processes described for Section 202 source categories.

Again, looking at the global emissions, methane emissions from Section 211 source categories were 0.01 percent of global, total GHG emissions in 2000. They accounted for 0.06 percent of global CH_4 emissions and 0.07 percent of global transportation emissions in 2000.

Section 211 methane emissions were 0.13 percent of total GHG emissions from motor vehicles and motor vehicle engines in 2005. Methane emissions from these source categories decreased by 46 percent between 1990 and 2005, largely due to decreased CH_4 emissions from passenger cars (59 percent) and light-duty trucks (43 percent). In 2005, CH_4 emissions from these source categories equaled 0.46 percent of total U.S. CH_4 emissions.

At this time, the Administrator is proposing two findings in the alternative. First, the Administrator proposes to find that, for purposes of Section 211, methane emissions from Section 211 source categories do contribute to the elevated combined level of GHG concentrations. Alternatively, the Administrator proposes to find that they do not. As discussed above, information and policy considerations could support a final determination on either option, and thus, the Administrator is soliciting comment on both possible final determinations.[22] The rationale supporting each proposal is described in the discussion of the methane emissions from Section 202 sources. There are modest differences in the percentages of emissions associated with different comparisons; the data specific to Section 211 methane emissions are summarized in [ADD REFERENCES].

d. Request for comment on the contribution of nitrous oxide emissions from Section 211 source categories to the elevated combined level of GHG concentrations

Nitrous oxide (N_2O) is emitted from Section 211 source categories through the same processes described for Section 202 source categories.

Nitrous oxide emissions from Section 211 source categories were 0.15 percent of total, global GHG emissions in 2000. Compared to the smaller subsets of global transportation emissions and global nitrous oxide emissions, Section 211 source category N_2O emissions were just over 1 percent and 1.5 percent respectively in 2000.

When looking at U.S. emissions, N_2O emissions from Section 211 source categories accounted for 1.9 percent of total GHG emissions from motor vehicles and motor vehicle engines in 2005. Nitrous oxide emissions from these source categories decreased by 14 percent between 1990 and 2005, largely due to decreased N_2O emissions from passenger cars (33 percent). In 2005, N_2O emissions from these source categories equaled 7.7 percent of total U.S. N_2O emissions.

Based on this information, at this time, the Administrator is proposing two findings in the alternative. First, the Administrator proposes to find that, for purposes of Section 211, nitrous oxide emissions from Section 211 source categories do contribute to the elevated combined level

22 Detailed methane emissions data for Section 211 source categories are presented in Tables [ADD REFERENCES].

of GHG concentrations. Alternatively, the Administrator proposes to find that they do not. As discussed above, information and policy considerations could support a final determination on either option, and thus, the Administrator is soliciting comment on both possible final determinations.[23] The rationale supporting each proposal is as described in the discussion of the methane emissions from Section 202 sources. There are modest differences in the percentages of emissions associated with different comparisons; the data specific to Section 211 nitrous oxide emissions are summarized in Tables A.29–A.31 of [ADD REFERENCES].

e. HFCs, PFC and SF_6 emissions

Hydrofluorocarbons are not an emission product of a fuel or fuel additive. Thus, unlike section 202 source categories, Section 211 source categories do not emit any HFCs. Perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6) also are not emitted from Section 211 source categories.

f. Information regarding total GHG emissions from Section 211 source categories

As discussed above, the Administrator is proposing to define "air pollutant(s)" for purposes of making the sections 202/211 contribution findings as the individual GHGs emitted by the Section 202 and 211 source categories. Nonetheless, the Administrator is seeking comment on whether, instead, to make the contribution finding as to the emissions of these four substances collectively. Thus, the following discussion summarizes information in [ADD REFERENCES] on emissions of total greenhouse gases (CO_2, CH_4, N_2O, and HFCs) from Section 211 source categories.[24] The Administrator notes that if he were to define the "air pollutant" as the collective group of four to six greenhouse gases, he would likely find contribution on the basis that he is already proposing that CO_2 alone contributes. Additionally, given that total greenhouse gas emissions from Section 202 source categories are almost 5 percent of total global GHG emissions, adopting this definition of "air pollutant" would make it unnecessary to assess the individual GHG emissions levels less than that amount.

Due to the large share of emissions from passenger cars, light-duty trucks, and medium/heavy-duty trucks in 2005, the overall emissions and trends from Section 211 source categories are very similar to those presented for Section 202. From 1990 to 2005, greenhouse gas emissions from Section 211 source categories grew by 34 percent. In 2005, CO_2 made up the largest share of emissions (98 percent), followed by N_2O (1.9 percent) and CH_4 (0.13 percent). In 1990, Section 211 source categories emitted 23 percent of total U.S. emissions, behind the electricity generation sector (30 percent) and the industrial sector (24 percent), but by 2005 the total had climbed to 26 percent, surpassing the industrial sector. Section 211 greenhouse gas emissions were 35 percent of global transport greenhouse gas emissions and 5.2 percent of total global emissions in 2000.[25] The global transport sector was 15 percent of all global greenhouse gas emissions in 2000.

[23] Detailed nitrous oxide emissions data from Section 211 source categories are presented in [ADD REFERENCES].
24 Detailed data on all greenhouse gas emissions from Section 211 source categories are presented in Tables [ADD REFERENCES].
[25] The year 2000 is the most recent year for which comprehensive greenhouse gas emissions data are available for all gases, all countries, and all sources. Global estimates are 'gross' emissions estimates and do not include removals of greenhouse gas emissions from the atmosphere by terrestrial sinks (i.e., forests and other biomass).

g. Request for comment on contribution proposals

The Administrator is seeking comment on the above proposals regarding contribution of carbon dioxide, methane and nitrous oxide emissions from fuels and fuel additives used in Section 211 source categories to the elevated combined GHG concentrations. Specifically, the Administrator is interested in comments regarding the data and comparisons underlying the analysis contained in [ADD REFERENCES]. The Administrator also welcomes comment on prior precedents for assessing contributions, as well as the precedential impact of today's contribution findings for other potential sources of these and other greenhouse gases. We also welcome comment on the relationship of these proposals to existing U.S. climate change emissions reduction programs and the magnitude of reductions sought under these programs.

The Administrator is proposing fuel standards that take into consideration emissions of CO_2, N_2O and CH_4, conditioned on a final decision that emissions of one or both of the non-CO_2 GHGs from Section 211 sources do contribute to the relevant air pollution. Based on EPA's evaluation in the fuels proposal of the various emissions, EPA also expects that a final decision that N_2O or CH_4 do or do not contribute would not lead to any significant change in the fuel standard.