



# **Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act:**

## **EPA's Response to Public Comments**

### **Volume 9: The Endangerment Finding**

# **The Endangerment Finding**

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Office of Atmospheric Programs  
Climate Change Division  
Washington, D.C.**

## FOREWORD

This document provides responses to public comments on the U.S. Environmental Protection Agency's (EPA's) Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, published at 74 FR 18886 (April 24, 2009). EPA received comments on these Proposed Findings via mail, e-mail, and facsimile, and at two public hearings held in Arlington, Virginia, and Seattle, Washington, in May 2009. Copies of all comment letters submitted and transcripts of the public hearings are available at the EPA Docket Center Public Reading Room, or electronically through <http://www.regulations.gov> by searching Docket ID *EPA-HQ-OAR-2009-0171*.

This document accompanies the Administrator's final Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act (Findings) and the Technical Support Document (TSD), which contains the underlying science and greenhouse gas emissions data.

EPA prepared this document in multiple volumes, with each volume focusing on a different broad category of comments on the Proposed Findings. This volume of the document provides responses to public comments regarding the endangerment finding.

In light of the very large number of comments received and the significant overlap between many comments, this document does not respond to each comment individually. Rather, EPA summarized and provided a single response to each significant argument, assertion, and question contained within the totality of comments. Within each comment summary, EPA provides in parentheses one or more lists of Docket ID numbers for commenters who raised particular issues; however, these lists are not meant to be exhaustive and EPA does not individually identify each and every commenter who made a certain point in all instances, particularly in cases where multiple commenters expressed essentially identical arguments.

Several commenters provided additional scientific literature to support their arguments. EPA's general approach for taking such literature into consideration is described in Volume 1, Section 1.1, of this Response to Comments document. As with the comments, there was overlap in the literature received. EPA identified the relevant literature related to the significant comments, and responded to the significant issues raised in the literature. EPA does not individually identify each and every piece of literature (submitted or incorporated by reference) that made a certain point in all instances.

Throughout this document, we provide a list of references at the end of each volume for additional literature cited by EPA in our responses; however, we do not repeat the full citations of literature cited in the TSD.

EPA's responses to comments are generally provided immediately following each comment summary. In some cases, EPA has discussed responses to specific comments or groups of similar comments in the Findings. In such cases, EPA references the Findings rather than repeating those responses in this document.

Comments were assigned to specific volumes of this Response to Comments document based on an assessment of the principal subject of the comment; however, some comments inevitably overlap multiple subject areas. For this reason, EPA encourages the public to read the other volumes of this document relevant to their interests.

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## Acronyms and Abbreviations

°C	degrees Celsius
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CCSP	U.S. Climate Change Science Program
CFC	chlorofluorocarbon
CH <sub>4</sub>	methane
CO <sub>2</sub>	carbon dioxide
EPA	U.S. Environmental Protection Agency
FACE	Free-Air CO <sub>2</sub> Enrichment
GDP	gross domestic product
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
HCFC	hydrochlorofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
N <sub>2</sub> O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NF <sub>3</sub>	nitrogen trifluoride
ODS	ozone-depleting substance
OMB	Office of Management and Budget
PFC	perfluorocarbon
PM	particulate matter
PM <sub>2.5</sub>	fine particulate matter (particles less than 2.5 micrometers in diameter)
ppm	parts per million
SDWA	Safe Drinking Water Act
SF <sub>6</sub>	sulfur hexafluoride
SO <sub>2</sub> F <sub>2</sub>	sulfuryl fluoride
TSD	Technical Support Document
UNFCCC	United Nations Framework Convention on Climate Change
USGCRP	U.S. Global Change Research Program
W/m <sup>2</sup>	watts per square meter

## **9.0 The Endangerment Finding**

### **9.1 Proposed Definition of “Air Pollution”**

#### **Comment (9-1):**

Many commenters argue that EPA does not have the authority to establish domestic rights and obligations based on environmental conditions that are largely attributed to foreign nations and entities that are outside the jurisdiction of EPA under the Clean Air Act (CAA). They contend that in this case, the bulk of emissions that would lead to mandatory emissions controls under the CAA would not and could not be regulated under the CAA. They state that CAA requirements cannot be enforced against foreign sources of air pollution, and likewise domestic obligations under the CAA cannot be caused by foreign emissions that are outside the United States. The commenters also argue that EPA committed procedural error by not addressing this legal issue of authority in the proposal.

#### **Response (9-1):**

Section IV.A.7.a. of the Findings responds to this comment concerning the global nature of the air pollution.

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#### **Comment (9-2):**

Some commenters argue that EPA must make a specific determination that potential climate change resulting from increased U.S. greenhouse gas (GHG) levels is endangering U.S. public health and welfare; i.e., that U.S. GHG emissions are causing climate change, and then that the climate change from U.S. emissions may reasonably be anticipated to endanger public health and welfare. They contend that under Section 202(a), the “air pollution” is limited to the domestic air only, not global air. Commenters contend that unless provided otherwise, the CAA authorizes EPA to regulate only domestic emissions with localized effects, citing various provisions of the CAA that discuss the “Nation’s air resources” and focus on controlling emissions at the source to support their argument. They also note that when Congress intended to authorize EPA to cover non-domestic air pollution, it specifically said so, citing Sections 115 and 179B and Title VI in support of its argument. Given these specific international provisions, Congress must have meant to limit EPA’s authority under other sections (e.g., Section 202). Commenters contend that EPA created its illegal local-global-local (U.S. motor vehicle emissions–global GHG concentrations–U.S. climate change impacts) approach because it cannot legally draw the line from U.S. motor vehicle emissions to U.S. endangerment of public health or welfare.

Still other commenters claim that the air pollution EPA analyzes for endangerment must be limited to the relative contribution of emissions from U.S. new motor vehicles to associated health or welfare impacts. They disagree with EPA’s consideration of total, global concentrations of GHGs.

#### **Response (9-2):**

EPA disagrees with the commenters on both scientific and legal grounds regarding their view of the appropriate scope of the air pollution for purposes of determining endangerment under Section 202(a) of the Act. Similar to the previous response, please refer to Section IV.A.7.a for our response. With respect to the assertion that EPA should subtract projected emissions resulting from mitigation policies, please refer to Sections III.C. and V.C. of the Findings for our response.

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#### **Comment (9-3):**

A number of commenters argued that carbon dioxide (CO<sub>2</sub>) and the other GHGs should not be defined as the air pollution because these gases do not cause direct human health effects, such as through inhalation.

**Response (9-3):**

Responses to such comments are provided in Section IV.B.1.f in the discussion of the public health nature of the endangerment finding.

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**Comment (9-4):**

Some commenters argue that EPA's proposed definition of "air pollution" is arbitrary because unlike criteria pollutants, they contend, just one molecule of CO<sub>2</sub> or methane (CH<sub>4</sub>) is not pollution. Rather, CO<sub>2</sub> and CH<sub>4</sub> are components of perfectly clean air. Some commenters state that because, in the past, CO<sub>2</sub> levels were much higher than they are today and the air was not polluted by anthropogenic emissions, defining "air pollution" as GHGs is not coherent. Many commenters make similar arguments that CO<sub>2</sub> is a natural and necessary component of the earth's atmosphere, and that some global warming is necessary for life on earth; thus, GHGs cannot be considered pollutants under the CAA, nor can they be found to endanger public health or welfare.

**Response (9-4):**

EPA disagrees that the definition of air "pollution" employed in the Findings is arbitrary or unreasonable. The fact that the CO<sub>2</sub> and CH<sub>4</sub> are natural components of the ambient air is immaterial given the Act's definition of "pollutant" (refer to Section II.B of the Findings). The definition of "air pollution" is informed by the definition of "air pollutant," which the CAA defines as

Any air pollution agent or combination of such agents, including any physical, chemical, biological, radioactive (including source material, special nuclear material, and byproduct material) substance or matter which is emitted into or otherwise enters the ambient air.

(CAA Section 302[g]). It makes sense that if a substance can be an air pollutant, which is defined as an air pollution agent or combination thereof, then it is reasonable to consider certain ambient concentrations of that air pollutant as air pollution. As discussed elsewhere, the Supreme Court held that GHGs are air pollutants under the Act, specifically finding that CO<sub>2</sub>, CH<sub>4</sub>, nitrous oxide (N<sub>2</sub>O), and hydrofluorocarbons (HFCs) fit the Act's "sweeping definition of 'air pollutant'" since they are "without doubt 'physical [and] chemical...substances which [are] emitted into...the ambient air.'" (549 U.S. 497, 529 [2007]).

The Act does not appear to preclude a naturally occurring substance in the atmosphere from being designated as an air pollutant. Many of the criteria pollutants also have natural background components to the air concentrations. The issue of the harmfulness of the air pollution and the anthropogenic contribution to the air pollution by human sources are brought in by the endangerment and contribution criteria in Section 202(a). Commenters are attempting to read those criteria into the term "air pollution" itself, and that is not appropriate. In this action, the air pollution—representing the cumulative stock of the air pollutant in the atmosphere—has been defined as the *elevated* concentration of well-mixed GHGs in the atmosphere and is not referring to natural background levels. Thus, the major concern is the buildup of GHGs in the atmosphere and the associated risk of harm to public health and welfare via the climate change that results. The Technical Support Document (TSD) summarizes the evidence about the risks and impacts to human health and welfare associated with elevated atmospheric concentrations of GHGs. See Section IV.B.1 of the Findings justifying the Administrator's rationale for finding that the air pollution, defined as the elevated atmospheric concentrations of six key long-lived, well-mixed GHGs in the atmosphere, is endangering the public health of current and future generations, via the climate change effects induced by the GHGs. Section IV.B.1.f in particular responds to these comments that EPA may only consider the health effects from direct exposure to the pollutants. Lastly, the Supreme Court noted, "[a]t any rate, no party to this dispute contests that GHGs both 'ente[r] the ambient air' and tend to warm

the atmosphere. They are therefore unquestionably ‘agent[s]’ of *air pollution*.” (549 U.S. at 529, n.26, emphasis added).

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**Comment (9-5):**

Several commenters agree that the proposal to define the air pollution as the mix of the six directly emitted and long-lived GHGs is consistent with the statutory definition of “air pollutant” as any air pollution agent or combination of agents that is emitted into or otherwise enters the ambient air (42 U.S.C. §7502[g]). These commenters note that the Administrator reasonably justifies her proposal to include all six gases on grounds that these GHGs are well-studied and the primary focus of climate change research to date, and that they share the relevant physical properties of being long-lived and globally mixed in the atmosphere, being directly emitted rather than formed through atmospheric chemical reactions, and acting through the common greenhouse mechanism of trapping outgoing heat that would otherwise escape into space. The commenters also note that much of the scientific research and assessment effort focused on human-induced climate change has treated these gases collectively. Moreover, they contend that an advantage of collectively addressing these six gases is that their relative radiative forcing impacts (i.e., global warming potentials [GWPs]) are well-established, so equivalencies between them can readily be determined. These commenters agree that the proposed definition is not overbroad, is consistent with EPA’s past practice of treating a class of substances with similar physical or chemical properties and environmental impacts as a single air pollutant under Section 202 (even in cases when not all components of the class are emitted from motor vehicles) and is operationally justified by the common treatment of this suite of compounds in scientific research and assessment studies.

**Response (9-5):**

EPA agrees with these lines of reasoning, as spelled out in Section IV.A of the Findings, for defining the air pollution for purposes of the endangerment finding under Section 202(a) of the Act as the aggregate mix of the six long-lived, well-mixed GHGs.

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**9.1.1 Aggregate vs. Individual Gases**

**Comment (9-6):**

Numerous commenters disagree with EPA’s proposal to define “air pollution” as the group of six GHGs, and argue that EPA must look at each GHG individually to determine if it endangers public health or welfare. They complain that any findings that follow from this approach will effectively lump six materially different and disparate GHG agents together as one amorphous and perplexing mixture for purposes of regulation, and if applied in the broader context of the entire CAA, will establish a problematic and inappropriate regulatory precedent by disassociating specific pollutants from the relative contribution of each that is attributable to a particular source and obscuring their respective climate impacts.

**Response (9-6):**

EPA disagrees with each of the arguments put forward by the commenters as to why air pollution should not be defined as the aggregate group of the six long-lived, well-mixed GHGs. Section IV.A.1. of the Findings provides the Administrator’s rationale for the air pollution consisting of the six key GHGs. In addition, while the term “air pollution” is not defined, the term “air pollutant” clearly includes the discretion to combine air pollution agents together and treat them as a single, group air pollutant. This lends support to the view that air pollution can likewise be seen as an atmospheric concentration of a group of compounds. EPA has a clear past practice of doing so where appropriate; e.g., the air pollution of atmospheric concentrations of particulate matter (PM) can be made up of many different chemical



compounds. Finally, commenters' arguments concerning disassociating specific pollutants from their relative contribution and obscuring their relative impacts relates to the definition of air pollutant that EPA employs in the contribution determination, and not the definition of air pollution for purposes of the endangerment determination.

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### **9.1.2 Carbon Dioxide**

#### **Comment (9-7):**

Numerous commenters have objected to the classification of CO<sub>2</sub> as a pollutant because CO<sub>2</sub> is necessary and/or beneficial for plant growth (0153, 0219, 0246, 0300, 0425, 0439, 0509, 0525, 0536, 0541, 1217.1, 1468, 1519, 2157, 2682.1, 2759, 2885, 2916.1, 3013, 3377.1, 0714.2, 4632, 5058, 7022, 11455); they provide a number of references (e.g., Nemani et al., 2003, Woodward, 1987, Gleadow et al., 1998). Some of these commenters (0536, 7026) attribute increases in historical agricultural and ecosystem productivity to increasing CO<sub>2</sub>, and others note that greenhouses often use CO<sub>2</sub> concentrations over 1,000 parts per million, or ppm. Many of these commenters believe that increasing CO<sub>2</sub> is a good thing for human and ecosystem welfare due to its beneficial effect on plants, often citing Free-Air CO<sub>2</sub> Enrichment (FACE) experiments, or that plants in CO<sub>2</sub> enhanced conditions can survive with less water. Some commenters (0246, 0401, 0541, 1217.1, 1468, 6810) state that under current concentrations the atmosphere is "starved" of CO<sub>2</sub>; they worry that if CO<sub>2</sub> decreases further that it would endanger the biosphere, often citing William Happer's testimony to Congress. Similarly, many (0401, 0591, 1924, 1927, 3446.1) note that CO<sub>2</sub> is at historic lows. A commenter (2895) states that food has increased antioxidant levels under higher CO<sub>2</sub> conditions.

Similarly, commenters (0422, 0439, 0509, 0639.1, 0711.1, 2157, 2885, 3291.1, 1519, 7022, 11455) state that CO<sub>2</sub> is exhaled by living things and is natural, or that all cells in every living organism are based on carbon, and therefore CO<sub>2</sub> cannot be a pollutant. Some commenters (2885, 3548.1) cite the dictionary definition of "foul, unclean, dirty" and states that CO<sub>2</sub> does not meet this criterion.

#### **Response (9-7):**

EPA disagrees with the comments that CO<sub>2</sub> cannot be considered part of the "air pollution" and "air pollutant" in the Findings because it is a naturally occurring gas and can have direct beneficial effects for plant growth, as these arguments ignore the fundamental scientific and legal bases underpinning the Administrator's rationale. See the above response to this aspect of the commenters' critique. Section IV.B.1.f of the Findings in particular responds to comments that EPA may only consider the health effects from direct exposure to the pollutants.

The issues raised by commenters concerning beneficial effects or the carbon basis of organic life are considered in determining whether the air pollution as defined endangers public health or welfare, not in defining the air pollution. Regarding some of the beneficial effects for vegetation due to elevated concentrations of CO<sub>2</sub>, such comments are responded to in Volume 6 of this Response to Comments document, which covers agriculture and forestry. The TSD summarizes the assessment literature on the CO<sub>2</sub> fertilization effect in Section 3. Section IV.B of the Findings describes the Administrator's approach in weighing the potential benefits due to elevated CO<sub>2</sub> concentrations and climate change and the potential risks, including their magnitude and likelihood.

Those commenters who submitted comments about an atmosphere "starved" for CO<sub>2</sub> and possible damage to the biosphere should note that current concentrations are already 30% to 130% above the levels seen in 800,000 years of ice core records and are likely to keep increasing in the absence of concerted efforts to reduce emissions. Therefore, while CO<sub>2</sub> concentrations may be low compared to the

average of the past billion years, EPA finds it is much more relevant that CO<sub>2</sub> concentrations are very likely higher than anything seen in the past million years.

Regarding the Nemani et al. reference submitted by at least one commenter, see our response in Volume 6, Section 6.2, of the Response to Comments document. In addition, refer to that volume for responses pertaining to the FACE experiments mentioned by the comments. Regarding the comments, and the referenced testimony of Dr. William Happer, which state that because enhanced CO<sub>2</sub> concentrations lead to benefits, CO<sub>2</sub> emission reductions will actually be detrimental, we note two things. First, these Findings themselves do not address how to respond to the climate change problem, let alone suggest specific CO<sub>2</sub> concentration targets. Second, we disagree with these comments that greater CO<sub>2</sub> and GHG concentrations lead to net benefits, given the weight of the evidence in all climate-sensitive sectors of public health, society, and the environment that there are a number of risks and impacts associated with climate change that results from the buildup of atmospheric GHGs.

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**Comment (9-8):**

A number of commenters (0439, 0509, 0582, 0639.1, 1468, 2682.1, 2759, 2885, 2979) note that CO<sub>2</sub> has no toxic effects at expected ambient levels, citing submarines and other examples of high CO<sub>2</sub> environments. Several commenters (0219, 0426, 2156) cite Bohr's work on the role of CO<sub>2</sub> in human respiration, noting that 6.5% CO<sub>2</sub> in our lungs is healthy. A commenter (3394.1) objects to inclusion of CO<sub>2</sub> toxicity information because the TSD implies that these effects could result from atmospheric concentrations and anthropogenic emissions.

**Response (9-8):**

As was clearly stated in the Executive Summary and Appendix C of the TSD, current and projected atmospheric concentrations of GHGs are not expected to pose direct exposure risks, and therefore direct toxic effects are not included in the endangerment finding. Therefore, the issue raised by Bohr's work referenced by the commenter is already included in the TSD and taken into consideration by the Administrator in the Findings. Section IV.B.1.f of the Findings in particular responds to comments that EPA may only consider the health effects from direct exposure to the pollutants.

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**Comment (9-9):**

At least one commenter (3568.1) argues that carbon emissions from biomass do not contribute to endangerment to public health or welfare. They posit that biomass is CO<sub>2</sub> neutral, as the CO<sub>2</sub> released back to the atmosphere when emitted contains the same carbon that was recently removed or sequestered from CO<sub>2</sub> in the atmosphere. The commenter states that the neutrality of biomass CO<sub>2</sub> has been repeatedly recognized by an abundance of studies and accepted by agencies, institutions, regulations and legislation, including the Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC) in their reporting protocols. Furthermore the comment notes, in proposing its Mandatory Reporting Rule for GHGs, EPA itself has made clear the exclusion of biomass CO<sub>2</sub> emissions quantities for the calculation of thresholds for determining obligated facilities. For all of these reasons, the commenter finds that biomass CO<sub>2</sub> should be excluded as contributing to the air pollution.

**Response (9-9):**

First, all CO<sub>2</sub> emissions, regardless of source, influence radiative forcing equally once it reaches the atmosphere and therefore there is no distinction between biogenic and non-biogenic CO<sub>2</sub> regarding the CO<sub>2</sub> and the other well-mixed GHGs within the definition of air pollution that is reasonably anticipated to endanger public health and welfare.

Second, the Administrator is finding that the well-mixed GHG emissions from Section 202(a) source categories (i.e., on-road transportation vehicles and therefore not biomass-burning) contribute to the air pollution that may reasonably be anticipated to endanger public health and welfare. The Administrator's findings are for purposes of Section 202(a) of the Act.

Lastly, the IPCC emissions calculation methodologies do not say that biomass is CO<sub>2</sub> neutral but rather that any CO<sub>2</sub> emissions or removals resulting from changes in carbon stocks related to land use, land-use change, and forestry should be tracked in that sector comprehensively rather than in the energy sector where the biomass might be consumed.

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**Comment (9-10):**

One commenter (3828.1) stated that a “critical level” of CO<sub>2</sub> cannot be determined, even if the 2° C target is taken as a given, because model climate sensitivity can range from 1.5 to 11.5°C, so a critical level cannot be determined within a factor of 10. The commenter asserts that a 2°C warming might be inevitable already, so the situation is hopeless and “we might as well live it up.”

In contrast, several commenters (0916, 6180, 10172) request that CO<sub>2</sub> be reduced to 350 ppm, and another warned that 410 ppm is a critical threshold beyond which CH<sub>4</sub> feedbacks from permafrost warming will lead to a 9° Kelvin warming by 2100. A commenter (2895) requests that the Agency also consider removing the existing atmospheric concentrations of anthropogenic GHGs, in addition to limiting emissions.

**Response (9-10):**

Commenters have misinterpreted the scope of the endangerment and cause or contribute findings. The Administrator's Findings are a determination that the air pollution of well-mixed GHGs may reasonably be anticipated to endanger the public health and welfare of current and future generations. It is not a decision that is based on or identifies any specific *response* to the endangerment determination—whether through GHG mitigation or adaptation or a combination of both. These Findings do not attempt to determine a quantitative threshold for a level of GHG concentrations in the atmosphere, for future policy purposes or to determine a level above which there is (or below which there is not) endangerment. The Administrator's rationale for finding endangerment is explained in Section IV of the Findings.

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**Comment (9-11):**

A commenter (2818) states that the research on “CO<sub>2</sub> domes” (Jacobson, 2008) shows that reductions of local CO<sub>2</sub> can reduce local air pollution deaths.

**Response (9-11):**

EPA is aware of this research being conducted by Dr. Jacobson. This work appears to generally support the Administrator's endangerment finding that CO<sub>2</sub> and other GHGs may reasonably be anticipated to endanger public health and public welfare.

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**9.1.3 Methane**

**Comment (9-12):**

A commenter (3699.1) requests that biogenic CH<sub>4</sub> and GHG emissions from biogenic CH<sub>4</sub> sources be excluded from the endangerment finding, in order not to deter renewable biogas projects. The commenter

worries that regulation of such sources under the CAA will make these projects ineligible for offset credits, and that such regulation would more likely lead to inexpensive abatement options such as flaring rather than biogas. The commenter further requests that all GHG emissions resulting from biological process associated with livestock be excluded. The commenter worries about a 250 tons per year reporting threshold. One commenter (2682.1) states that controlling CH<sub>4</sub> is difficult, that EPA is unwilling to accept waste incineration, and that controlling livestock CH<sub>4</sub> will make meat and milk expensive and so deprive the poor.

**Response (9-12):**

The benefits or dis-benefits of potential future abatement strategies are not pertinent to determining whether the GHG air pollution endangers. With regard to biogenic CH<sub>4</sub>, the finding of contribution is in relation to emissions from Section 202(a) sources under the Act covering on-road vehicles only, and relates to the aggregate group of the well-mixed GHGs from Section 202(a) source categories.

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**Comment (9-13):**

One commenter (3636.1) requests that the GWP for CH<sub>4</sub> be reconsidered, preferring as one possibility the use of the 20-year GWP for short-lived gases.

**Response (9-13):**

EPA is aware of the interest in considering a shorter timeframe such as 20 years (versus the standard 100-year timeframe) for CH<sub>4</sub> to emphasize its climate impact over the near term. However, it is EPA's view that these Findings are not the appropriate context within which to consider whether or not the standard practice of using 100-year GWPs for CH<sub>4</sub> and the other well-mixed GHGs should be reconsidered. It has been EPA practice to use 100-year GWPs from the IPCC Second Assessment Report, in accordance with reporting guidelines under the UNFCCC.

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**Comment (9-14):**

A commenter (2818) raises the issue whether or not the endangerment finding would allow EPA to look at the potential for methane clathrate development, which some in the energy industry are exploring.

**Response (9-14):**

EPA is aware of the interest in methane clathrates (or hydrates), but this issue is not germane to the Findings, as the Findings by themselves are not based on and do not address or consider potential future energy policies.

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#### **9.1.4 Nitrous Oxide**

**Comment (9-15):**

One commenter (2682.1) states that controlling N<sub>2</sub>O will raise the cost of dental care.

**Response (9-15):**

The economic effects of potential future regulation are not relevant to determining whether there is endangerment from elevated levels of GHG concentrations.

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**Comment (9-16):**

One commenter (3427.1) states that text is apparently missing from page 18,908, second column, fourth full paragraph, and should be re-proposed for public comment (nitrous oxide section).

**Response (9-16):**

Evaluating the text on page 18,908, second column, fourth full paragraph, it appears that there was a superfluous word, “section” in the phrase “from section these,” and that the full sentence should have read, “If the Administrator were to evaluate nitrous oxide as a separate air pollutant, she would consider the emissions from section 202(a) source categories to contribute to the air pollution, placing primary weight on the fact that nitrous oxide emissions from these source categories are significant in terms of their contribution to U.S. (and global) emissions of that particular gas.” This editorial error is not significant and would not likely have led to a misinterpretation about any of the issues put forward by the Administrator in the Proposed Findings.

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**9.1.5 Hydrofluorocarbons, Perfluorocarbons, and Sulfur Hexafluoride**

**Comment (9-17):**

One commenter (2818) encourages addressing existing HFCs and F-gases in air conditioners, insulation, etc. Similarly, another commenter (2895) suggests a number of actions for reducing F-gas emissions, including better enforcement of venting laws, taxes, restrictions on buying and handling of the gases, fines for leakage, and subsidizing development of alternatives. A commenter (3494.2) submitted Velders et al. on “The large contribution of projected HFC emissions.”

**Response (9-17):**

Consideration of appropriate emission reduction measures is not pertinent to the determinations on whether new motor vehicle emissions contribute to the GHG air pollution, or whether the GHG air pollution endangers.

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**Comment (9-18):**

A commenter (3196) notes that regulations should differentiate between tail-pipe emissions such as CO<sub>2</sub> and substances that are leaked from closed systems in very small amounts, such as HFCs and hydrochlorofluorocarbons (HCFCs). Additionally, the commenter advises caution when regulating substances without good replacements, especially because some of these compounds are used by public transit vehicles which displace a large quantity of CO<sub>2</sub>. Requiring increased training of service technicians is suggested as an alternative.

**Response (9-18):**

The details of potential future regulation are not relevant to determining whether there is endangerment from elevated levels of GHG concentrations.

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**Comment (9-19):**

A commenter (2682.1) states that controlling sulfur hexafluoride (SF<sub>6</sub>) will deprive EPA of a tracer gas, which, according to the commenter, is the main role of SF<sub>6</sub>.

**Response (9-19):**

These contribution and endangerment Findings are not based on considerations of potential, future regulations of SF<sub>6</sub> or any of the other well-mixed GHGs, and thus this issue is not germane to these Findings.

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**9.1.6 Additional Substances**

**9.1.6.1 Black Carbon**

**Comment (9-20):**

Black carbon was discussed by a number of commenters. Several commenters (2818, 2895, 3591.1) requested that black carbon be included in the Findings because of its effects on climate. A commenter (0308.1) states that black carbon is a significant contributor to climate change, clearly second only to CO<sub>2</sub>, and that restriction of emissions would produce immediate climate benefits, would be “low-hanging fruit,” and would enable the U.S. to assume “rightful leadership based on science, not political expediency.” The commenter states that the international focus on the six specified pollutants is “not a reasoned justification for failing to consider black carbon.” Another commenter (1191.1) states that EPA rejected inclusion of black carbon on two criteria: a lack of data and a short lifetime compared to CO<sub>2</sub>. This commenter stated that there is sufficient scientific evidence of the warming effect of black carbon, citing Shindell et al. (2009) and other literature, and noted that the EPA already regulates tropospheric ozone, which has an even shorter lifespan than black carbon. A commenter (2818) claims that U.S. soot emissions have led to more warming than either CH<sub>4</sub> or N<sub>2</sub>O, and reductions of soot would be the most effective method of reducing Arctic sea ice loss.

**Response (9-20):**

Section IV.A.6.a. of the Findings provides our response to these comments and provides the Administrator’s rationale for not including black carbon in the definition of air pollution for these particular Findings.

Black carbon is not a long-lived, well-mixed GHG but rather an aerosol particle. The mechanisms of black carbon’s climate effects are different from those of the major GHGs, as black carbon absorbs incoming and reflected light of all wavelengths, rather than just outgoing infrared radiation, and it affects the albedo of ice, snow, and clouds, which does not need to be directly taken into account for the major GHGs. The uncertainty of the contribution to global forcing is much greater, as evidenced by the uncertainty ranges presented in Forster et al. (2007) and Ramanathan and Carmichael (2008). The short lifetime of black carbon means that, unlike all the other well-mixed GHGs covered by the Findings, black carbon is not well-mixed in the atmosphere. The climatic effects of black carbon will therefore depend both on the location and timing of emissions—near-Arctic versus southern latitudes, mid-winter versus summer, before a rainfall versus before a long dry spell—unlike the GHGs. The projections of black carbon loading into the future are very different in nature from those for the GHGs, as the long-lived nature of GHGs results in continual accumulation in the atmosphere, whereas the short-lived aerosols are flow pollutants that disappear soon after being emitted. And because of the inclusion of PM in air pollution control measures, where black carbon can be affected by some PM control measures, the future emissions of black carbon could follow a very different pathway from the major GHGs as well. As stated in the TSD, a U.S. Climate Change Science Program (CCSP) study concluded that “we could not find a consensus in this report on the duration, magnitude, or even sign (warming or cooling) of the climate change due to future levels of the short-lived gases and particles” due to uncertainties about different pollution control storylines.

Nevertheless, we recognize that black carbon is an important forcing agent and EPA takes very seriously the emerging science about how black carbon may be contributing to climate change in general and the high rates of observed climate change in the Arctic in particular (e.g., Shindell et al., 2009). We have determined that black carbon deserves a separate and careful evaluation from these Findings for GHGs given the number of science, technical, and policy issues that are different compared to those for the major well-mixed GHGs. As stated, EPA has petitions pending before it relating to black carbon.

We also note that a number of commenters who urge control of black carbon also recognize the same difficulties of including black carbon in the current Findings as we do (see comments below).

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**Comment (9-21):**

A commenter (3414.1) objects that the TSD does not adequately summarize the most recent science on black carbon, citing the Ramanathan and Carmichael (2008) paper already referenced in the TSD, as well as Quinn et al. in Atmospheric Chemistry and Physics, and highlighting the lack of discussion of black carbon in the TSD's discussion of Arctic warming and sea ice melt. The commenter states:

We agree with EPA that black carbon should not simply be lumped into a single definition of "air pollution" with the greenhouse gases listed in the proposal. We wish to make clear that we are not suggesting that EPA needs to address black carbon in the same final action that addresses the greenhouse gases for which endangerment and contribution findings have already been proposed. We are not suggesting any delay in taking final action on those determinations in order to address black carbon. However, the fact that black carbon need not be regulated along with the greenhouse gases in the proposed endangerment finding does not mean that EPA is excused from its mandatory duty to issue an endangerment finding for this damaging climate active pollutant. Because, as described below, black carbon emissions also meet each factor of the 202(a) test, EPA must issue an endangerment finding and issue regulations for its reduction. Any further delay in finalizing the endangerment finding for the greenhouse gases is also unacceptable, however, and for this reason we suggest that the EPA finalize its proposed finding for the greenhouse gases and move forward with the associated regulations immediately. On a parallel track, the EPA should issue a separate endangerment finding and regulations for black carbon. We believe this is the most expeditious and efficient way for EPA to meet its statutory obligations.

**Response (9-21):**

We agree that now is not the appropriate time to "lump" black carbon into a single definition of air pollution that includes the major well-mixed GHGs. We recognize that new science relating to black carbon is moving quickly; however, for reasons outlined in Section III of the Findings and in Volume 1 of the Response to Comments document, we have chosen to rely on major assessment documents produced by IPCC, the U.S. Global Change Research Program (USGCRP)/CCSP, and U.S. government agencies for a number of reasons. The science continues to evolve on black carbon, and it is not clear whether or not a final global estimate of forcing will be closer to that of Forster et al. (2007) or that of Ramanathan and Carmichael (2008), and the issue of attributing changes in Arctic temperature to black carbon, ozone, and the well-mixed GHGs is also complicated and not yet well resolved. (In Volume 3 of this Response to Comments document, we do provide a response to comments about attributing Arctic warming to anthropogenic emissions including soot emissions). However, we have now included a statement in the TSD noting that the snow-albedo effect of black carbon has possible implications for Arctic and glacial melt.

EPA will use the emerging climate science of black carbon as a guide on what the appropriate responses should be for black carbon within the climate and air quality policy frameworks.

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**Comment (9-22):**

Several commenters (3475.14, 3609.1, 4036.5) agree that black carbon is an important forcing agent, but request that it be addressed in the near future and not necessarily in this action. A commenter (3344.1) justifies their recommendation by citing the differences between the properties of black carbon and the six GHGs. The commenter urges that EPA undertake such a separate rulemaking expeditiously. Another commenter (3472.1) has similar reasoning, but notes that evaluations of control measures should take into account aerosol indirect effects and reductions of co-emissions with cooling properties in order to calculate net effects of the measure, rather than just crediting black carbon reductions, and suggests continued research as well as an endangerment finding for black carbon. A commenter (4004.1) suggests that black carbon should be more tightly controlled under the National Ambient Air Quality Standards (NAAQS), and that climate impacts should be included in the NAAQS review cycle. Another commenter (3475.14) states, “Thus, we recommend that EPA act quickly to close any remaining gaps in scientific knowledge to include BC within an amendment to this finding or in the next endangerment finding addressing other source categories under the Clean Air Act.”

Commenters (3387.2, 3500.1) submitted a number of papers on the science, transport, inventories, and mitigation options involved in the relation between black carbon and climate.

**Response (9-22):**

For the reasons discussed above and in the Findings, EPA agrees that black carbon should not be included in an endangerment finding for the major GHGs at this time. We are aware of the literature submitted by the commenters, including, for example, Shindell et al. (2009), Quinn et al. (2008), Sarofim et al. (2009), and others, and find that in general this body of literature supports the conclusions found in the TSD.

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**Comment (9-23):**

A commenter (3591.1) states that black carbon emissions from vehicles contribute a significant percentage of black carbon in the United States, and that emission control technology (namely diesel particulate filters) that is commercially available can significantly reduce black carbon emissions from diesel vehicles.

**Response (9-23):**

The performance characteristics of available or potential abatement technologies are not relevant to determining whether there is endangerment from elevated levels of GHG concentrations. For reasons stated in the Findings in Section IV.A.6 and in previous responses, black carbon is not being included in the definition of air pollution for the Findings. Black carbon will receive its own evaluation separate from these Findings. The issues raised by the commenter here are therefore appropriate for consideration for black carbon’s assessment separate from these Findings.

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**Comment (9-24):**

Some commenters note that in addition to the light duty vehicle rules announced by the President in May 2009, EPA must regulate GHGs and black carbon from other Section 202(a) sources, including heavy-duty trucks. Other commenters provide information to assist EPA in the development of emissions standards for mobile sources.



**Response (9-24):**

Issues related to potential future regulation are not relevant to determining whether there is endangerment from elevated levels of GHG concentrations. See Sections I and III of the Findings, where the appropriate scope of the endangerment and cause or contribute analysis is discussed.

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**9.1.6.2 Other Substances**

**Comment (9-25):**

A commenter (3605.1) states that EPA has elected to include, in the definition of climate change air pollution, three groups of gases that cumulatively contribute 0.02 watts per square meter ( $W/m^2$ ) to radiative forcing, and which are not emitted in significant quantities by motor vehicles—while electing to exclude black carbon and tropospheric ozone smog, which contribute 0.9 and 0.35  $W/m^2$ , respectively, to radiative forcing, and which are derived in large part, if not primarily in the U.S., from motor vehicles. They note that this could be significant since the two excluded pollutants have approximately 60% of the radiative forcing effect of the six gases selected by EPA. They posit that strategies to mitigate climate change should be built around the definition of the gases that contribute most to radiative forcing.

**Response (9-25):**

We acknowledge that the IPCC indicates significant radiative forcing contributions from tropospheric ozone and black carbon. Our rationale for excluding black carbon (a short-lived aerosol) and tropospheric ozone (a short-lived gas) from the definition of air pollution in this action is based on the fact that black carbon and tropospheric ozone do not share all of the same common attributes with the six well-mixed GHGs. Responses to this issue regarding black carbon in particular are provided in the previous section, and responses to the inclusion of tropospheric ozone follow in this section. See Section IV.A.6 of the Findings for the Administrator's rationale for defining the air pollution as the six long-lived, well-mixed GHGs.

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**Comment (9-26):**

Several commenters support the manner in which the TSD and Proposed Findings address ozone, though they have some different approaches to the matter. One commenter (2889.1) cautions that defining ozone/GHG interactions would introduce complications, and supports the approach of the current proposed finding. Another commenter (3475.1) states that the climatic effects on ozone concentrations alone should be sufficient for endangerment. A third commenter (4004.1) also agrees that climate change is likely to worsen tropospheric ozone. Despite noting that ozone has a warming effect, this commenter agrees that the Proposed Findings should not include tropospheric ozone as a GHG, but suggests that NAAQS and other tools be used to reduce ozone levels to a level (such as 60 parts per billion) that would improve health and reduce climate forcing at the same time.

**Response (9-26):**

We agree with the comments that including tropospheric ozone in the definition of air pollution for these Findings is not appropriate at this time. We also agree with the comments that the risk of increased tropospheric ozone levels as a result of human-induced climate change provides support for the finding of endangerment to public health. Section 8(a) of the TSD summarizes the assessment literature which states that increases in regional ozone pollution in the U.S. relative to ozone levels without climate change are expected due to higher temperatures and a modification of meteorological factors, which will increase the risks of a number of health factors. The Findings in Section IV.B.1 explain the Administrator's consideration of these climate change impacts with respect to a finding of endangerment to public health. Regarding the use of NAAQS to achieve further ozone reductions, these Findings do not put forth any

strategies or recommendations regarding climate or air quality policy, as such issues are outside the scope of the endangerment analysis and of these Findings.

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**Comment (9-27):**

Several commenters (2683.1, 3186) propose that more substances should be included in the Proposed Findings. For example, a number of commenters specifically addressed the inclusion of chlorofluorocarbons, or CFCs. Some (2683.1, 3425.1) claim that the Montreal Protocol only addresses production of ozone-depleting substances (ODSs), and therefore that “ODS banks” are not regulated, citing the IPCC/Technology and Economic Assessment Panel Special Report on Safeguarding the Ozone Layer. One commenter notes that the CFCs in U.S. “ODS banks” represent 5 gigatonnes of CO<sub>2</sub> equivalent gas. The commenters propose that the Findings should therefore include ODS emissions from such banks, reminding EPA that the reductions in ODS have already had significant impacts on climate as shown by Velders et al. (2007). The commenter notes as examples of the importance of these banks that amendments have been proposed for the Montreal Protocol to cover these stocks of ODSs, and that HR2454 includes a provision to allow destruction of ODS to qualify for offsets. Another commenter (3186) notes that CFCs and HCFCs share the key properties of other GHGs and should therefore be included in the endangerment finding.

One commenter also addresses the inclusion of “synthetically produced GHGs” in the proposed endangerment finding. The commenter (2782.1) notes that new GHGs such as nitrogen trifluoride (NF<sub>3</sub>), sulfuryl fluoride (SO<sub>2</sub>F<sub>2</sub>), and hydrofluoroethers should be included in the proposed Finding as they meet the physical and chemical criteria for being listed, and otherwise a separate finding would need to be released later (they include references for NF<sub>3</sub> such as Weiss et al. (2008), and references for SO<sub>2</sub>F<sub>2</sub> such as Dillon et al. (2008)).

**Response (9-27):**

See Section IV.A.6.b of the Findings for the Administrator’s rationale for not including the ozone-depleting substances CFCs and HCFCs and NF<sub>3</sub> from the definition of air pollution. ODS banks, while not currently under direct Montreal Protocol regulation, are clearly within the domain of that Protocol.

We also note that the submitted study by Weiss et al. (2008) shows a calculation of the atmospheric abundance of NF<sub>3</sub> in the atmosphere, and that the submitted study by Dillon et al. (2008) assesses the properties, including absorption properties, of SO<sub>2</sub>F<sub>2</sub>. NF<sub>3</sub> and fluorinated ethers also have GWPs. However, given that radiative forcing estimates of these substances are not yet well quantified by the major scientific assessments, EPA is not prepared to include these gases in the definition of air pollution, alongside the well-studied and well-understood (in terms of their radiative forcing estimates and hence their contribution to human-induced climate change) six well-mixed GHGs. EPA will nevertheless continue to monitor and evaluate the science and policy actions addressing these gases.

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**Comment (9-28):**

At least one commenter (2889.1) supports the decision to not include Montreal Protocol gases in the endangerment proposal.

**Response (9-28):**

We agree that these gases should not be included in these Findings for the reasons discussed in Section IV.A. of the Findings, and for reasons discussed in our responses to this issue in this volume.

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**Comment (9-29):**

A number of commenters (e.g., 2885, 3509.1, 3577.1, 3702.1, 3747.1) question the exclusion of water vapor from the definition of air pollution because it is the most important GHG responsible for the natural, background greenhouse effect.

Many commenters argue that water vapor has a greater contribution to the greenhouse effect than any other substance. Several commenters (e.g., 1924, 0639.1) note that water vapor is produced by combustion, and question its exclusion (one commenter noted that it constitutes 26% to 45% of the products of combustion).

Similarly, a commenter (3397) objects to the categorization of anthropogenic water vapor emissions as insignificant, and contends that they are the same percentage as CO<sub>2</sub> emissions. The commenter indicates that EPA provides no reference for the implication that water vapor is not “long-lived” in the atmosphere. Furthermore, the commenter notes that the Millennium Ecosystem Assessment has estimated that 750 cubic kilometers (750 billion meter tons) of water vapor are released annually by human activities, or 6% of the global total. The commenter notes that one-third of this annual amount is fossil water that is not recharged to the ground water. The commenter requests that EPA at least explain why anthropogenic emissions of water vapor should be considered insignificant.

One commenter states that this exclusion demonstrates that the finding is arbitrary and capricious, because water vapor is the most abundant GHG and therefore the CAA compels the inclusion of water vapor in the definition of air pollution. The commenter claims that the inclusion of non-202(a) compounds SF<sub>6</sub> and perfluorocarbons (PFCs) weakens the argument that direct water emissions from motor vehicles are negligible. The commenter requests more discussion of water vapor, including localized variations due to irrigation and contrails. Furthermore, the commenter states that if direct emissions of water vapor are excluded from the endangerment finding, then it is inconsistent to include water vapor from feedbacks for the other GHGs.

**Response (9-29):**

We disagree that the decision to exclude water vapor from the definition of air pollution in the Findings is arbitrary. Please refer to Section IV.A.6.b of the Findings for the Administrator’s rationale for water vapor’s exclusion from the definition of air pollution. We also provide a more comprehensive discussion of scientific and technical issues relating to water vapor in Volume 2, Section 2.1 of this Response to Comments document on alternative explanations of observed changes.

Our review of the assessment literature (e.g., Solomon et al., 2007) indicates that the direct emission of water vapor by human activities makes a negligible contribution to radiative forcing. The IPCC finds that anthropogenic use of water is less than 1% of natural sources of water vapor and that human activities have only a small direct influence on the amount of atmospheric water vapor (Forster et al., 2007). That the residence time of water vapor in the atmosphere is relatively short (typically on the order of 3 to 10 days) is undisputed in the scientific community and has been calculated or directly measured in numerous peer-reviewed studies (e.g., Howarth, 1983; Trenberth, 1998; Miao et al., 2001). Over longer time periods, the water content of the air is a function of temperature and partial pressure, with emissions playing virtually no role.

The IPCC (Forster et al., 2007) also addressed anthropogenic contributions to water vapor arising from large-scale irrigation, but assigned it a very low level of understanding, and suggested that the cooling from evaporation might outweigh the warming from its small radiative contribution. The IPCC (Forster et al., 2007) states that the emissions from combustion sources are small in comparison: “The emission of water vapour from fossil fuel combustion is significantly lower than the emission from changes in land use.” We reviewed the Millenium Ecosystem Assessment referenced by the commenter, and were unable

to find the statistic regarding the release of 750 cubic kilometers of water vapor annually by human activities. The available literature does not confirm this amount.

Water vapor produced at higher altitudes does potentially have an impact on radiative forcing and thus climate change. The IPCC (Forster et al., 2007) estimated the contribution of changes in stratospheric water vapor due to CH<sub>4</sub> and other sources, as well as high altitude contributions from contrails, and concluded that both contributions were small, with a low level of understanding.

The inclusion of SF<sub>6</sub> and PFCs and exclusion of water vapor from the definition of air pollution for these Findings is justifiable when considering anthropogenic emissions of water vapor have a negligible effect on atmospheric concentrations and are short-lived. SF<sub>6</sub> and PFCs, on the other hand, are long-lived in the atmosphere and their atmospheric concentrations have changed significantly as a direct result of anthropogenic emissions.

EPA does not include in its definition of air pollution for this action water vapor emissions arising from warming temperatures associated with elevated concentrations of GHGs. Rather, this is a climate change effect or feedback as a result of the air pollution.

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## **9.2 Preventive Nature of an Endangerment Finding**

### **Comment (9-30):**

Various commenters argue either that the endangerment test under Section 202(a) is not precautionary and preventive in nature, or that EPA's interpretation and application is so extreme that it is contrary to what Congress intended in 1977, and effectively guarantees an affirmative endangerment finding. Commenters also argue that it improperly shifts the burdens to the opponents of an endangerment finding and is tantamount to assuming the air pollution is harmful unless it is shown to be safe.

### **Response (9-30):**

See Section II.A of the Findings for a response regarding the Administrator's application of the precautionary and preventive nature of the statutory language.

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### **Comment (9-31):**

Several commenters argue that it is unlawful for EPA to make an affirmative endangerment finding unless EPA finds that the regulatory control measures contemplated to follow such a finding would prevent at least a substantial part of the danger from the global climate change at which the regulation is aimed. This hurdle is also described by commenters as the regulation "achieving the statutory objective of preventing damage," or "fruitfully attacking" the environmental and public health danger at hand by meaningfully and substantially reducing it. Commenters point to *Ethyl Co. v. EPA*, 541 F.2d 1 (D.C. Cir. 1976) (en banc) as support for this view, as well as portions of the legislative history of this provision.

Commenters contend that EPA has failed to show that this required degree of meaningful reduction of endangerment would be achieved through regulation of new motor vehicles based on an endangerment finding. In making any such showing, commenters argue, EPA would need to account for 1) the fact that any regulation would be limited to *new* motor vehicles, if not the subset of new motor vehicles discussed in the President's May 2009 announcement; 2) any increase in emissions from purchasers delaying purchases of new vehicles subject to any GHG emissions standards, or increasing the miles traveled of new vehicles with greater fuel economy; 3) the fact that only a limited portion of the new motor vehicle emissions of GHGs would be controlled; 4) the fact that Corporate Average Fuel Economy (CAFE)

standards would effectively achieve the same reductions; and 5) the fact that any vehicle standards would not themselves reduce global temperatures.

**Response (9-31):**

See Section II.A.2.b. of the Findings for a response.

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**Comment (9-32):**

Commenters argue that Congress established a minimum requirement that there be a “significant risk of harm” to find endangerment. They contend that this requirement stemmed from the *Ethyl Corp.* case, and that Congress adopted this view. According to the commenters, the risk is the function of two variables, the nature of the hazard at issue and the likelihood of its occurrence. Commenters argue that Congress imposed a requirement that this balance demonstrate a “significant risk of harm” to strike a balance between the precautionary nature of the Act and the burdensome economic and societal consequences of regulation.

**Response (9-32):**

See Section II.A.2.c. of the Findings for a response.

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### **9.3 Finding that Air Pollution Endangers Public Health and Welfare**

**Comment (9-33):**

Some commenters argue that EPA can decline to make an endangerment finding at this time due to the inadequacy of the scientific record. They state that because most, if not all, of the studies relied upon by EPA in the Proposal do not evaluate the individual effects of the six GHGs identified nor do they evaluate their effect as emitted from new motor vehicles, such information must be developed before EPA can finalize any endangerment finding for these GHGs. They contend that the science establishing the nexus between these six GHGs and climate change is inconclusive.

**Response (9-33):**

EPA disagrees with these commenters who claim the scientific record is inadequate to make an endangerment finding at this time. The finding of endangerment is based on the effects of the air pollution that we have defined as the well-mixed GHGs, and the scientific record before the Agency is adequate to make this determination. Since the endangerment determination is not based on the separate effects of the individual gases, nor on the effects of the gases emitted solely by motor vehicles, the adequacy of the science to support that kind of endangerment determination is not at issue here. Section IV.A of the Findings describes the Administrator’s rationale for defining the air pollution as the six well-mixed GHGs, and why their treatment as an aggregate group is justified. Section IV.A.7.a of the Findings, in particular, responds to comments critiquing consideration of the global nature of the air pollution, rather than the “air pollution” that can be solely attributed to Section 202(a) sources.

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**Comment (9-34):**

Commenters state that endangerment is evident from EPA’s own summary:

While the endangerment TSD (April 2009 version that accompanied the Proposed Findings) cites the many media and resources projected to be affected by climate change (pp. 64-110), the projected impacts on U.S. air quality alone (pp. 70-75)—a topic obviously at issue in any endangerment determination under the Act—would suffice for

an endangerment determination here. In addition, we note that other U.S. publications, including others by EPA, reiterate and expand upon the TSD findings regarding air quality. These include the U.S. Climate Change Science Program's Synthesis and Assessment Product 4.6, and the report "Scientific Assessment of the Effects of Global Change on the United States"; 2009 Interim Report of the U.S. EPA Global Change Research Program Assessment of the Impacts of Global Change on Regional U.S. Air Quality: A Preliminary Synthesis of Climate Change Impacts on O<sub>3</sub>.

They point out that recently published and peer-reviewed information makes the wildfire/ozone connection even clearer (Pfister et al., 2008). They claim that this study adds to previous studies showing a clear impact on air quality from the greater incidence and intensity of wildfires projected for California and other western states from global warming. Finally, an emerging body of research indicates that there is a direct link between CO<sub>2</sub> emissions—before they reach the upper atmosphere—and local or regional mortality (Jacobson, 2008).

**Response (9-34):**

We agree with the comment that the full scientific record, and the scientific assessment literature as summarized in the TSD in particular, support the Administrator's determination that the well-mixed GHGs may reasonably be anticipated to endanger public health and public welfare. We also agree that the evidence demonstrating the risks of increased tropospheric ozone as a result of human-induced climate change, summarized in Section 8(a) of the TSD, provides support for the Administrator's determination that there is endangerment to public health. See Section IV.B.1 of the Findings for the Administrator's weighing of these particular factors. The conclusions of the referenced studies (CCSP Synthesis and Assessment Product 4.6 [CCSP, 2008] and EPA Interim Assessment [U.S. EPA, 2009]) are incorporated in the TSD and are therefore considered by the Administrator in these Findings. We note that the work of Pfister et al. shows how wildfires can contribute to regional increases in tropospheric ozone. The issue of how human-induced climate change may increase the severity of wildfires, which can in turn affect air quality, is considered in the TSD and the Findings. Finally, we are aware of the emerging work by Dr. Jacobson regarding localized effects of locally emitted CO<sub>2</sub> emissions. Thus far, this work seems to suggest that the results would support the Administrator's determination that CO<sub>2</sub> and the other well-mixed GHGs may reasonably be anticipated to endanger public health and welfare.

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**Comment (9-35):**

A commenter argues that the endangerment claimed appears to be a matter of "secondary" endangerment, for example, the potential for low-lying areas to experience higher flood risk. The commenter notes that those pollutants that are already regulated under 202(a) constitute a direct endangerment to people's health, whereas these new "gases" for consideration, namely CO<sub>2</sub>, N<sub>2</sub>O, and CH<sub>4</sub>, can only cause "secondary" endangerment.

**Response (9-35):**

See Section IV.B of the Findings for the Administrator's rationale as to why the various effects of climate change are properly considered as public health and public welfare concerns for purposes of determining that the six well-mixed GHGs may reasonably be anticipated to endanger under Section 202(a) of the Act.

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**Comment (9-36):**

At least one commenter notes that EPA has not specified how much action by the U.S. Administration would be adequate to protect human health and welfare from catastrophic climate change. These commenters state that numerous studies have concluded that to prevent catastrophic climate change, worldwide average temperatures cannot rise by more than 2°C (3.6° Fahrenheit) above pre-industrial levels, and that further research shows that to have an approximately 50% chance of keeping warming below 2°Celsius, atmospheric GHG concentrations must stabilize below 450 ppm. They conclude by stating that to adequately address the risk of harm to human health and welfare posed by climate change, the United States must take aggressive steps to limit GHGs in the very near term.

**Response (9-36):**

Setting GHG emission reduction targets in order to achieve certain climate benefits or avoid the risks and impacts associated with different global GHG atmospheric concentration levels is beyond the scope of these Findings, because these would be regulatory or policy responses to climate change. Sections III.C and F of the Findings discuss the appropriate parameters of the endangerment test with regard to potential policy or regulatory responses to the threat of climate change. This action does not specify a particular atmospheric GHG concentration threshold to avoid. We understand that the public health and welfare risks associated with human-induced climate change increase as GHG concentrations climb, and note that this view is consistent with the scientific record before the Administrator.

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**Comment (9-37):**

Several commenters discuss how GHGs are different from other pollutants. EPA has evaluated for endangerment in the past. They focus on how GHGs come from many sources, all over the world, and that U.S. emissions are only one part of the problem. Commenters note that GHGs are long-lived, global atmospheric concentrations are relatively homogenous, and there are no immediate or near immediate effects from the GHGs as with traditional pollutants (e.g., effects on health and welfare are several steps removed from the GHG emissions themselves). Given these differences between GHGs and traditional pollutants, commenters urge EPA to carefully examine the Section 202(a) endangerment language to decide if the words should be given a different, or more considered, meaning under these new and unique circumstances.

**Response (9-37):**

EPA recognizes the differences between the well-mixed GHGs and the more traditional air pollutants under the Act. See Section IV.A of the Findings for the Administrator's rationale as to why the six well-mixed GHGs are grouped together in the definition of air pollution for purposes of the endangerment finding under Section 202(a) of the Act. The common attributes shared by the six well-mixed GHGs are not all common to other air pollutants. Section IV.A.7 in particular responds to comments critiquing the global nature of the Administrator's definition of air pollution. On the issue of whether the language under Section 202(a) should be interpreted differently in light of the nature of the well-mixed GHGs and the climate change problem, Section II.A of the Findings describes the text and legislative history of Section 202(a) and how the Administrator interprets this language.

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**Comment (9-38):**

At least one commenter argues that EPA must show endangerment directly from the air pollution itself, and not through a welfare effect like climate change. They contend that EPA is attempting to rewrite Section 202(a) so that it reads "which in his judgment cause, or contribute to, ~~air pollution~~ **an effect on welfare** which may reasonably be anticipated to endangerment public health or welfare." The same commenter argues that because EPA is defining air pollution and air pollutants to both be composed of

the mix of six GHGs, EPA similarly is rewriting Section 202(a) by replacing the word “air pollutant” with “air pollution.” The commenter contends that it is meaningless circumlocution to state that a mix of six GHGs causes or contributes to a mix of six GHGs.

**Response (9-38):**

Section IV.A of the Findings describes the Administrator’s rationale for defining the air pollution. Sections V.A and C of the Findings describe the Administrator’s rationale for defining the air pollutant and its relation to the air pollution, as well as the meaning of “contribution.” The determination of whether the air pollution may reasonably be anticipated to endanger public health or welfare clearly includes consideration of the effects of the air pollution on climate, and the effects on public health and welfare of these effects on climate. This is described in the Findings in Sections II and IV, which discuss EPA’s interpretation of the endangerment criteria, and the terms public health and public welfare. EPA disagrees with the comment that it is “meaningless circumlocution” to state that GHG emissions from section 202(a) source categories contribute to the atmospheric concentrations, the air pollution, of those same GHGs. It is logical that emissions of a certain substance from a source category can cause or contribute to the atmospheric concentration of that same substance. The terms “cause” and “contribute” have meaning because they are tied to the emissions from a specified source category. As described in Section V.A of the Findings, it is typical for the Administrator to consider this type of contribution; for example, the Administrator analyzes *PM<sub>2.5</sub> emissions* to determine if a source category contributes to *PM<sub>2.5</sub> air pollution*.

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**Comment (9-39):**

At least one commenter (3217.1) suggests that considering history is an appropriate way for the Administrator to consider GHG endangerment to health or welfare. Over the past 100 years, the comment notes, temperature and GHG concentrations have both increased while global gross domestic product (GDP) has increased 18-fold, average life span has doubled, and per capita food supplies have increased even as global population has quadrupled. It posits that these improvements have been fueled by energy use which EPA proposes to regulate.

**Response (9-39):**

EPA disagrees with the commenters’ argument that because GHG concentrations have been rising while other metrics such as GDP and lifespan have also been rising, this supports the view that current and future levels of GHG atmospheric concentrations do not endanger public health or welfare. The TSD summarizes the science showing numerous risks and potential impacts to virtually all elements of human society and the environment from current and projected levels of GHGs. Many adverse impacts—the increase in wildfires in the western United States to name but one example—are an indication of how risks may already be occurring as a result of human-induced climate change. How society responds to climate change in the future is a subject beyond the scope of these Findings. Furthermore, the commenter does not explain or claim that there is a causal relationship between the historic changes in GDP, life span, and food supplies and the concurrent increases in temperature, GHG concentrations, and population. Instead the commenter assigns these benefits to an increase in energy use. The implication is that an endangerment finding will lead to less energy use in the future than otherwise would occur. As noted previously, the endangerment finding does not impose any such requirement. We further note that many factors such as advances in technological development, agricultural practices, and medicine likely influenced these trends which may or may not have been associated with energy use and attendant GHG emissions. As discussed in Section III.C of the Findings, societal actions (e.g., mitigation or adaptation) that may lessen the impact of the air pollution were not considered in these Findings.

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### 9.3.1 Public Health and Public Welfare Definitions

#### 9.3.1.1 Health

**Comment (9-40):**

Several commenters argue that EPA may only consider the health effects from direct exposure to pollutants in determining whether a pollutant endangers public health. The commenters state that EPA's proposal acknowledges that there is no evidence that GHGs directly cause health effects, citing 74 FR 18,901. To support their claim that EPA can only consider health effects that result from direct exposure to a pollutant they cite several sources, discussed in the Findings, Section IV.B.f.i.

**Response (9-40):**

See Section IV.B.1.f in the Findings for our response on this issue. EPA does not agree that the legislative history of the 1977 CAA amendments demonstrates that indirect health effects cannot be considered as public health effects. The language of the Act does not speak to this issue—the term “public health” is not defined, and the definition of “effects on welfare” does not reference indirect health effects. If Congress intended indirect health effects to be treated as welfare effects, the definition in §302(h) could have easily been amended to include this concept. Commenters cite excerpts from the legislative history in which “public health” is included when a member of Congress discussed air quality goals. See, e.g., the statement of Sen. Cooper, 1970 Leg. Hist. at 260 (“National air quality goals, as distinguished from standards, goals protective of public health as well as health...would also be established”). Such statements from individual Congressmen are not sufficient to demonstrate unambiguous Congressional intent that indirect health effects should be considered welfare effects. There are other statements suggesting that members of Congress thought welfare effects would encompass environmental effects. See, e.g., the statement of Sen. Muskie, 1970 Leg. Hist. at 227 (describing air quality goals as being “protective against any known or anticipated adverse environmental effects”). In addition, while language from the Senate report demonstrates Congress' concern with health risks from exposure to ambient air (“Ambient air quality is sufficient to protect the health...whenever there is an absence of adverse effect on the health...from exposure to the ambient air,” Sen. Rep. No. 91-1196 at 10), EPA does not believe this concern demonstrates that Congress intended to exclude indirect health effects from being considered health effects in the context of an endangerment finding. The history of the various changes from the early bills to the final bill adopted do not lead to this conclusion. The legislative history of the 1970 amendments does not compel a conclusion one way or the other on how indirect health effects are to be considered.

EPA does not believe the language quoted from the 1977 amendment is dispositive either. The language cited related to amendments to the Act that were intended to address issues arising from D.C. Circuit decision in *Ethyl Corp. v. EPA*, 541 F.2d 1 (D.C. Cir 1976). Congress amended the CAA in light of this case to make the Act clear on a number of points. A primary concern was to “emphasize the preventive or precautionary nature of the act,” and to allow the Administrator to “weigh risks and make reasonable projections of future trends” (H.R. REP. No. 95-294, at 49-50). The report stated: “the committee is moving in a direction which is consistent with most judicial interpretations of the act. Most courts have held that a substantial element of judgment, including making comparative assessments of risks, projections of future possibilities, establishing margins of safety and margins of error, extrapolating from limited data, etc., are necessary and permissible under the act in order to protect public health...” (Id. at 50-51). Thus, the congressional amendments were not intended to clarify or address how the Administrator should consider indirect health effects. EPA believes that the language cited by commenters is not on point as to whether indirect health effects are health effects or welfare effects.

**Comment (9-41):**

Several commenters argue that a public health endangerment finding under Section 202(a) would set a precedent for other sections, in particular that it would require EPA to ultimately issue a primary NAAQS for GHGs, and that a primary NAAQS could present significant implementation and compliance problems. Several commenters also suggest that a public health finding could subject private entities to increased litigation risk regarding health effects associated with GHG emissions. Thus, commenters urge EPA that if it moves forward with a positive endangerment finding it decline to make a public health finding now—since a finding of endangerment to public welfare alone satisfies the Section 202(a) requirement—and preserve the Agency’s flexibility moving forward.

**Response (9-41):**

As discussed in Section IV.B.f of the Findings, neither the CAA nor the legislative history clearly answer the question of whether indirect health effects are human health effects or welfare effects. EPA believes a reasonable and straightforward reading of the statute is that indirect health effects are human health effects rather than welfare effects. This view is also consistent with EPA’s past practice.

EPA agrees with the commenters that an endangerment finding can be premised on endangerment to either public health or welfare. Both types of effects need not be present. But EPA does not believe that use of the word “or” implies that EPA can simply ignore an effect in a given circumstance. The fact that an air pollutant endangers welfare does not mean EPA should end its inquiry of the pollutant’s effects. EPA believes that while the CAA provides discretion to base an endangerment finding on either public health or welfare effects, it reasonable for the Agency to examine both effects in determining whether an exercise of its CAA authority is called for. It is EPA’s view that the scientific record on GHGs and associated climate change before the Administrator supports the finding that there is endangerment to both public health (e.g., sickness and death due to heat-related effects, exacerbation of tropospheric ozone, and the increased frequency and severity of extreme weather events) and public welfare (e.g., risks to food production, forestry, water resources and infrastructure). It is also EPA’s view that to make an endangerment finding based only on either public health or public welfare would be too narrow of a reflection of the breadth and scope of the risks and impacts associated with GHGs and the climate change problem.

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**Comment (9-42):**

Several commenters (2898.1, 3136.1, 3283.1, 3347.1, 3347.3, 3394.1, 3449.1, 3603.1, 3722, 3747.1) indicate that air quality effects of climate change will be addressed through the Clean Air Act NAAQS process, as implemented by the State Implementation Plans and national regulatory programs. According to these commenters, these programs will ensure no adverse impact on public health due to climate change. Though climate change may cause certain air pollutant ambient concentrations to increase, states will continue to be compelled to meet the standards. So, while additional measures may be necessary, and result in increased costs, these commenters assert that, ultimately, public health will be protected by the continued existence of the NAAQS and therefore no endangerment with respect to this particular climate change–related impact will occur. A commenter states that EPA inappropriately assigns air quality risk to climate change that will be addressed through other programs. The CAA provides a mechanism to meet the standards and additional control measures consistent with the CAA will be adopted in the future, keeping pollution below unhealthy levels. The commenters state that the fact that NAAQS are in place requires EPA to fulfill its legal obligation to prevent this particular form of endangerment to public health.

**Response (9-42):**

See Section IV.B.1.f in the Findings for a detailed response to the issues involving consideration of the NAAQS.

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**Comment (9-43):**

A commenter (3529.1) states that for PM, the effect of global warming is less certain than for ozone, though the increased drought and wildfires predicted in a global warming world will increase PM levels. Global warming will clearly make achieving the ozone NAAQS more difficult for a number of areas, with a discernible impact on ozone levels over the summer and substantial impacts during peak pollution episodes during the summer. The primary ozone NAAQS are designed to protect public health, so the impact of global warming on the ozone NAAQS alone is enough to justify a finding of endangerment of public health (though there is ample evidence of other public health effects as well).

**Response (9-43):**

We agree research indicates that climate change will adversely impacts ozone in many areas. We also agree that PM air quality would be adversely impacted in areas where droughts and wildfires increase due to climate change. See Section IV.B.1.f for a response to comments concerning consideration of the NAAQS in the Administrator’s endangerment finding, and for this issue concerning the PM associated with wildfires. See Volume 5 of this Response to Comments document for our responses to comments and literature provided on the TSD’s discussion of air quality impacts.

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**9.3.1.2 Welfare**

**Comment (9-44):**

A commenter states that air quality effects were discussed in the TSD but are not included in the proposal’s discussion related to welfare. Thus, it does not appear that air quality effects were a consideration of the Administrator in proposing a welfare-based endangerment finding.

**Response (9-44):**

The exacerbation of tropospheric ozone due to human-induced climate change and the resulting impacts are considered by the Administrator in both the public health and public welfare part of the endangerment finding. Increases in PM as a result of increased wildfires due to climate change are also taken into account. Please see Sections IV.B.2.a and b for the Administrator’s consideration of these issues in the justification of the finding of endangerment to public welfare.

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**9.3.2 Articulation of Method Used by the Administrator to Find Endangerment**

**Comment (9-45):**

Several commenters (e.g., 3283.1, 3286.1, 4173) argue that EPA failed to adequately define the standards and methods the Administrator relied upon to find that atmospheric concentrations of GHGs endanger public health and welfare. One commenter (4173), for example, argues that EPA failed “to identify and articulate a systematic, scientifically supported process of review that will provide a complete, well-reasoned explanation of the basis for its Section 202 decision as well as the aspects of that review process that it would expect to use in making any future endangerment findings under the CAA with respect to other source categories.” Another of these commenters (3283.1) states that the endangerment finding is “arbitrary and capricious” because EPA failed to quantify either the probability or severity of effects. A commenter (3286.1) argues that the Proposed Findings lacked clarity as to the scope of climate effects

that are the subject of the analysis, and that it is impossible to determine based on the TSD “what precisely might be the ultimate sources of any possible endangerment.”

**Response (9-45):**

We disagree with the comments that the endangerment finding is arbitrary and capricious and that EPA failed to adequately articulate the standards and method the Administrator used to determine that the elevated atmospheric concentrations of the well-mixed GHGs are reasonably anticipated to endanger public health and welfare within the meaning of Section 202(a) of the CAA.

First, the TSD summarizes the scientific state of knowledge from the major assessment reports and identifies how elevated concentrations of GHGs and associated climate change affect human health, air quality, food production and agriculture, forestry, water resources, coastal areas, infrastructure, the energy sector, and ecosystems and wildlife, currently and projected into the future. The connection between these risks and impacts and the air pollution of the well-mixed GHGs occurs through the attribution of observed climate change to the anthropogenic buildup of GHGs. The TSD covers the attribution of observed climate change to anthropogenic GHG emissions in some detail in Section 5. The section reports, among other things, that IPCC has concluded that “[m]ost of the observed increase in global average temperatures since the mid-20<sup>th</sup> century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations.” Compared to the April 2009 version of the TSD, the most recent TSD includes an expanded discussion of attribution; however, consistent with the most recent assessment reports, it does not include any new information that would suggest that the root cause of recently observed climate change is anything but anthropogenic GHG emissions. A detailed discussion of comments on the attribution of observed climate change to increases in GHG concentrations can be found in Volume 3 of the Response to Comments document. We therefore disagree that it is impossible to determine based on the TSD “what precisely might be the ultimate sources of any possible endangerment.”

We also disagree that the scope of the Findings lacks clarity. The range of risks and impacts to public health and welfare were mentioned above and are summarized in the TSD. Section IV.A of the Findings clearly defines the scope and nature of the air pollution for the endangerment finding. Sections IV.B.1 and 2 of the Findings discuss the risks, impacts and potential benefits and disbenefits considered by the Administrator. Sections III.D and E of the Findings describe the temporal and geographic scope of the Administrator’s considerations for the endangerment finding.

With regard to the Administrator’s standards and methods, Section II.A of the Findings also explains the statutory framework within which the Administrator must make her judgment about determining endangerment. Section IV.A of the Findings describes the Administrator’s rationale for defining the air pollution as the six well-mixed GHGs. Section IV.B of the Findings describes the Administrator’s reasoning, methodology and weighing of multiple risks and impacts, and in some cases potential benefits, including their potential magnitude, time dimension, and the level of certainty associated with the identified risks and impacts. Given the information articulated in the Findings, we disagree with the comments that the Administrator did not adequately explain the standard or method for determining endangerment. In this regard, EPA noted such comments seeking greater clarity about the Administrator’s method and reasoning, and therefore the current Findings have an expanded and detailed explanation of the Administrator’s reasoning compared to the Proposed Findings.

We also disagree that we failed to identify and articulate a “systematic, scientifically supported process for review that will provide a complete, well-reasoned explanation of the basis for [EPA’s] Section 202 decision...” As comprehensively described in Volume 1 of this Response to Comments document, the information in the TSD underwent a rigorous review process that included technical review by 12 federal climate change experts, internal EPA review, and U.S. government interagency review. In addition, EPA

gained public input through the public comment period and in response revised the TSD and the Findings. A summary of the changes made to the TSD since the April 2009 version that accompanied the Proposed Findings can be found in a separate memo in the docket, “Summary of Major Changes to the Technical Support Document.” The TSD was developed and prepared in a manner fully consistent with EPA’s *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and integrity of Information Disseminated by the Environmental Protection Agency* (U.S. EPA, 2002).

We disagree that the Proposal was “arbitrary and capricious” because it failed to quantify the probability or severity of effects. Sections II.A.2.a and II.A.2.c respond to comments about the Administrator’s approach in light of the precautionary nature of the statutory language and in light of our ability to assess the risk of harm. Section IV.B discusses how the Administrator weighed the probability and severity of harms. Not every risk to or impact on public health and welfare can be quantified, and the endangerment analysis for the Administrator’s consideration is not limited to only those risks and impacts that can be quantified. As further described in Volume 1 of this Response to Comments document, the TSD and the Final Findings assess the likelihood and potential magnitude of effects due to elevated atmospheric GHG levels, primarily as assessed by IPCC and USGCRP. For reasons covered in detail in Volume 1, Section 1.4, of the Response to Comments document, the Administrator’s consideration of both adverse and beneficial effects due to elevated atmospheric GHG concentrations and climate change was consistent with the scientific information presented in the TSD and fully appropriate for purposes of an endangerment analysis.

Any review process for any other endangerment assessment beyond the scope of the current Findings is not relevant because the current Findings are limited to responding to the pending petition under Section 202(a) of the Act.

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**Comment (9-46):**

Commenters (e.g., 3394.1, 3347.1) argue that we must demonstrate or describe EPA’s attempt to weigh evidence, consider uncertainties, or balance positive and negative impacts; all relevant details of any such assessment and rationale are completely missing from the Proposed Findings. A commenter states to the extent EPA takes into account negative indirect health and welfare effects, the Agency must also take indirect positive effects into account in that analysis. The comment states the health of all affected persons, rather than some subset must be considered. Another commenter requests that the Proposed Findings explain EPA’s conclusions as to each of these factors for every climate-related effect that EPA evaluates because the current approach taken is insufficiently transparent and fails to provide an adequate scientific basis for the findings.

**Response (9-46):**

The Administrator’s approach in making the final endangerment finding does not lack transparency or provide an insufficient scientific basis. The range of risks and impacts to public health and welfare are summarized in the TSD. Sections IV.B.1 and 2 of the Findings discuss in detail the risks, impacts, and potential benefits considered by the Administrator. Sections III.D and E of the Findings describe the temporal and geographic scope of the Administrator’s considerations for the endangerment finding. The Administrator did consider the impact of climate change across the public in general, for both current and future generations, when evaluating the impact on public health and welfare. Where appropriate, she placed weight on the impacts on certain groups, such as children, the elderly, and the poor, who are most vulnerable to climate-related health effects.

With regard to the Administrator’s standards and methods, Section IV.B of the Findings describes the Administrator’s reasoning, methodology, and weighing of multiple risks and impacts, and where appropriate the known potential benefits, including their potential magnitude, time dimension, and the

level of certainty associated with the identified risks, impacts and benefits. Section II.A of the Findings also explains the statutory framework within which the Administrator must make her judgment about determining endangerment. Given the information articulated in the Findings, we disagree with the comments that the Administrator did not adequately provide for a standard or method for determining endangerment. In fact, this discussion in the Findings is substantially expanded as a result of such comments seeking greater clarity about the Administrator’s method and reasoning, and the Findings now provide a more detailed explanation of the Administrator’s reasoning as compared to the Proposed Findings.

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**Comment (9-47):**

At least one commenter argues that EPA must present the information relied on in a manner that is accurate, clear, complete, unbiased, and which conforms to standards drawn from the Safe Drinking Water Act. Specifically, they contend that the information must specify (i) each population addressed; (ii) the expected risk or central estimate of risk for each population; (iii) each appropriate upper- or lower-bound estimate of risk; (iv) each significant uncertainty and studies that would assist in resolving the same; and (v) peer-reviewed studies that support, are directly relevant to or fail to support estimates and methodologies used to reconcile inconsistencies in data.

**Response (9-47):**

The information and data requirement of the Safe Drinking Water Act may not necessarily be the same or relevant for requirements under Section 202(a) of the CAA, the statutory context of these Findings. Our responses to comments regarding the Safe Drinking Water Act, and its relationship to the Data Quality Act and the CAA, can be found in Volume 1, Section 1.5, of this Response to Comments document.

The Findings and TSD make it clear what scientific information is being relied upon for the Administrator’s decision. Volume 1 of the Response to Comments document and Section III.A of the Findings describe the rationale for primarily relying on the major scientific assessments, as summarized in the TSD. This information conforms to high standards of peer review. Section I of the Technical Support Document contains information on how uncertainty was characterized and communicated.

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### **9.3.3 Global and Domestic Scope of Endangerment Finding**

**Comment (9-48):**

A number of commenters (0157, 2750, 3252.1, 3332.1, 3347.1, 3397, 3427.1, 3394.1, 3509.1, 3603.1, 3635, 3702.1, 3702.2) argue that EPA does not have the authority to consider international effects within the context of the Proposed Findings. These commenters argue that the CAA was clearly not intended to apply outside the United States and that the international effects of GHG emissions are therefore not relevant to the endangerment analysis. One commenter (3347.1), for example, states: “International public health and welfare are not expressed among the stated purposes of the Act. To the contrary, when Congress intended for the Administrator to consider international impacts, Congress made explicit provisions for doing so.” Commenters argue that Congress addressed international impacts expressly in two other provisions of the CAA. They note that under Section 115, EPA considers emissions of pollutants that cause or contribute to air pollution that is reasonably anticipated to endanger public health or welfare in a foreign country, and that Section 179B addresses emissions of air pollutants in foreign countries that interfere with attainment of a NAAQS in the US. Because Congress intentionally addressed international impacts in those provisions, commenters argue that the absence of this direction in Section 202(a) means that EPA is not to consider international effects when assessing endangerment under this provision. A commenter (3397) states that any decision to count global benefits in a cost/benefit

calculation related to GHG regulation must be made by Congress. A commenter cites Office of Management and Budget (OMB) Circular #A-4 (OMB, 2003), asserting that OMB: “emphasized that the focus had to be on domestic costs and benefits and if EPA chose to reference international effects they should establish an accounting mechanisms to list it separately.”

Another commenter (2818), on the other hand, argues that EPA should take into account impacts that occur from U.S. emissions outside of the country. The commenter states: “The health effects that occur as a result of our emissions should count whether they are inside the border or out, as well as the potential effects that will be occurring into the future.”

**Response (9-48):**

See Sections III.D and IV.A.7.a of the Findings for a response to these comments regarding the global nature of the air pollution definition.

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**Comment (9-49):**

Several commenters (0157, 0565, 2692, 3397, 3476.1) state that reductions in U.S. GHG emissions would by themselves have little to no impact on either GHG emissions or global climate, and that the Proposal was therefore misguided.

A commenter (3476.1) states that EPA should consider prior federal agency comments and provided the following quotation attributed to a July 9, 2008, submission from the Secretaries of Agriculture, Transportation, Commerce, and Energy to OMB: “the Clean Air Act is premised on the idea that controlling emissions in the United States will improve air quality in the United States, and that a State or region can improve its air quality by controlling emissions.”

**Response (9-49):**

Section II.A.2.b of the Findings responds to comments about the relevance of considering the impacts of potential, future control measures following an endangerment finding. Section III.C of the Findings clarifies their scope with respect to adaptation and GHG mitigation issues.

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**Comment (9-50):**

Two commenters (3476.1, 3605.1) argue that EPA should explicitly consider global GHG emissions, particularly GHG emissions resulting from economic growth in developing countries. Both these commenters cite statistics from the Energy Information Administration about projected GHG emission growth in developing countries. One of them (3476.1) argues that emissions from China and India are likely to continue to grow rapidly and stated that annual energy-related emissions could double by 2030 even if the U.S. cuts its energy-related emissions to zero. Another commenter (3605.2) makes a similar point and states that EPA should evaluate the effectiveness of any CO<sub>2</sub> or GHG control program under the CAA in light of international and background emissions details.

**Response (9-50):**

We note that Section 2 of the TSD summarizes data on both global and U.S. GHG emissions, and that Section 6 of the TSD discusses projected future GHG concentrations and climate change and includes extensive discussion of the IPCC Special Report on Emissions Scenarios scenarios, which are explicitly based on plausible global emission scenarios.

The effects due to climate change discussed in the TSD are effects due to the global mix of GHGs in the atmosphere. The TSD clearly describes how the mix of long-lived GHGs is the result of cumulative,

global GHG emissions. Section V of the Findings explains how the Administrator considered global emissions of GHGs when determining whether GHG emissions from Section 202(a) source categories from the United States cause or contribute to the air pollution that endangers. With respect to potential, future control measures, Section II.A.2.b responds to comments about the relevance of considering the impacts of potential, future control measures following an endangerment finding. Section III.C of the Findings clarifies the scope of the Findings regarding adaptation and GHG mitigation issues.

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**Comment (9-51):**

A number of commenters (0800.1, 3297.1, 3394.1 3462.1, 3603.1) argue that the Proposal and TSD are not geographically tailored to impacts in the United States and that the Proposal is therefore flawed.

A commenter (3702.1) asserts that a limitation of the Proposed Findings is a lack of reliance on scientific evidence specific to the United States. According to the commenter: “EPA appears to partly mask this limitation by overstating the availability and confidence of scientific projections regarding U.S. impacts.” The commenter states that a projection made with a respect to a large regional area (e.g., North America) does not necessarily hold true for a smaller segment of that area in isolation and asserted that the findings should be revised to clarify whenever the agency is relying on general projections made at a scale beyond the U.S. alone. Another commenter (3394.1) makes a similar point, stating: “the TSD devotes substantial space to discussion of global emissions and global effects of climate change, often commingling discussion of these effects with discussion of U.S. impacts in a manner that prevents accurate assessment of the effects of climate change on U.S. resources alone.”

A commenter (0800.1) expresses concern that local and regional climates within the United States are not addressed in the Proposal. The commenter recommends dividing the United States into a series of climate units, consisting of state or multi-state units, and then observing climate changes at that level to provide the fidelity needed for a true assessment of climate change impacts on the United States.

A commenter (3297.1) states that reliance upon the IPCC in the proposal is problematic because the IPCC does not address U.S.-specific effect in isolation and deals mainly with effects and emissions at the global scale. The commenter states: “EPA’s adoption of the IPCC’s regional analysis of North America impacts, including projections for changes in temperature, precipitation, and sea level rise, cannot substitute for a U.S.-specific analysis because the IPCC’s analysis and EPA’s discussion of that analysis failed to distinguish adequately between U.S. and Canadian effects.”

**Response (9-51):**

Commenters who argued that the Proposed Findings were not adequately tailored to the United States did not accurately characterize the TSD’s treatment of the science of climate change as it relates to the United States. The Proposed Findings, the Final Findings, and the TSD rely significantly on U.S.-specific assessment reports and information. In particular, commenters did not address EPA’s extensive reliance upon 16 CCSP Synthesis and Assessment Products, many of which focus exclusively on the United States.

In addition to the Synthesis and Assessment Products of the USGCRP/CCSP included in the version of the TSD released with the Proposed Findings in April 2009, the final TSD summarizes the findings of the most recent USGCRP report: *Global Climate Change Impacts in the United States* (Karl et al., 2009). Published in June 2009, the report focuses specifically on the United States, includes extensive regional-scale analysis of U.S. regions, and has allowed us to add additional detail to both the continental- and regional-scale impact projections that were already included in the TSD. Our discussion of U.S. impacts accurately reflects the key conclusions of CCSP reports, as well as those from IPCC, and that we have carefully and accurately distinguished between global effects and U.S. effects.



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**Comment (9-52):**

Several commenters state that the United States contributes significantly to climate change and therefore has certain obligations with respect to impacts. A commenter (2895) states that the costs of reducing GHG emissions will be high but small compared to potential future climate impacts. The commenter gives particular note to impacts in developing countries and the creation of eco-refugees, asserting that major emitters of GHG emissions should be responsible for taking in these refugees. Another commenter (2895) states that the United States has contributed disproportionately to the problem of climate change by producing 25% of the world's emissions and suggests that policy responses to climate change need to address global equity issues.

**Response (9-52):**

Potential future policy responses to climate change are not germane to this action and are therefore not addressed in making the determination on endangerment.

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### **9.3.4 Temporal Scope of Endangerment Finding**

**Comment (9-53):**

Some public comments question making an endangerment finding based on current conditions (i.e., that there is currently not enough evidence that a danger exists now), while others question our ability to make an endangerment finding based on future projected conditions (i.e., that future risks and impacts are speculative and therefore of insufficient certainty to support an endangerment finding).

**Response (9-53):**

The TSD describes the observed climate change, how observed climate change can be attributed to the measured anthropogenic buildup of GHGs in the atmosphere, the observed effects of climate change on physical and biological systems, and the projected risks and impacts to public health and welfare as result of the expected range of climate change scenarios over time. Section III.E of the Findings explains the temporal scope of the Findings, which encompasses the timeframe consistent with the timeframe over which GHGs affect the climate. We disagree with the comments that neither current conditions nor future projected conditions support an endangerment finding, as this is inconsistent with scientific evidence, as summarized by the TSD, and inconsistent with the Administrator's weighing of such evidence. Section IV of the Findings describes the Administrator's rationale for finding that the well-mixed GHGs are reasonably anticipated to endanger public health and public welfare for *current* and *future* generations. The Findings also explain the time frames embodied in the terms *current* and *future* generations. The Findings describe the Administrator's consideration of current and future effects, and how certain risks, impacts, and benefits may change in character and magnitude for current versus future conditions.

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### **9.3.5 Consistency with Climate Policy Discussions Regarding Atmospheric Concentration Stabilization Targets**

**Comment (9-54):**

One commenter (10076) states that the world will overshoot its long-term target on GHG emissions within two decades, causing the average global temperature to rise above the threshold that could cause dangerous climate change during that time.

**Response (9-54):**

Specifying or discussing a “long-term target” that should be avoided is outside the scope of these Findings. We agree that continued significant emissions of GHGs will very likely lead to increased changes in global climate, and increased changes in global climate are likely to have a number of adverse effects on public health and public welfare.

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**Comment (9-55):**

Several commenters argue that EPA cannot base its finding primarily on projections of future concentrations and impacts and still find there is endangerment at current GHG concentrations. They contend that current effects are both less severe and less likely, and thus do not support an endangerment finding. Commenters accuse EPA of attempting to boot-strap current endangerment from projections about future GHG concentrations and effects. For example, many commenters disagree that current GHG concentrations (estimated at 387 ppm) constitute “endangerment” or “pollution” under EPA’s definition. They note that current concentrations are well below the 450 ppm concentration goal of H.R. 2454 and other climate policy-making organizations. Commenters urge that to be consistent with emerging Congressional policy, EPA should revise its proposed definition of “pollution” to indicate that current atmospheric concentrations of GHGs are not an endangerment to human health and welfare, and should realign its endangerment definition to the outcome of legislative action.

Other commenters argue that EPA must recognize that there are natural levels of GHGs in the atmosphere that are necessary to sustain the environment, and thus EPA has an obligation to define an atmospheric concentration above which there is endangerment. They set forth the following example in support of their argument: If we were able to develop the technological capability to return GHG levels in the atmosphere to their pre-industrial concentrations, under the Administrator’s proposed definition of “pollution,” their presence in the air would still be endangering public health and welfare, and EPA might be forced to regulate sources that contribute to the endangerment. Others argue that EPA cannot be suggesting that we should return to pre-industrial levels.

**Response (9-55):**

EPA disagrees that there is insufficient evidence to find that there is endangerment to current generations, and disagrees that the finding of endangerment to current generations is based primarily on future projections. Section III.E of the Findings explains the temporal scope of the Findings. By “current generations,” EPA means a near-term time frame of approximately the next 10 to 20 years. Section IV.B of the Findings describes the Administrator’s consideration of both current and future effects, and how certain risks, impacts, and benefits may change in character and magnitude for current versus future conditions. The TSD documents not only future risks from elevated GHG concentrations but also current risks. For example, we note that it has been estimated that unusually hot days have already become more frequent and that heat is presently the leading cause of weather-related deaths in the United States; that climate change has very likely already increased the size and number of wildfires; and that sea level is rising along much of the U.S. coast and coastal wetland loss is being observed.

EPA is defining the air pollution as the “elevated” concentration of the six GHGs on the basis that, among other factors, the increase in ambient concentrations of these GHGs has already been shown to be affecting the climate.

Possible or pending actions of Congress based on specific atmospheric GHG concentration levels and related discussions are not germane to these findings. Discussions in the climate change science and policy communities about the appropriate level of an ultimate GHG concentration stabilization scenario are also not germane, as they are in essence discussions about the appropriate policy response to the endangerment. As stated in the Findings, GHG mitigation considerations are very important but are not relevant to the determinations that must be made as part of these Findings. EPA also does not need to

define a specific level below which there is not endangerment—the issue before EPA is to judge whether the current and projected future air pollution of elevated concentrations of GHGs at issue here endangers.

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**Comment (9-56):**

A commenter (1468) indicates that “climate change” as used in this finding is undefined and unbounded because “climate change” has been taking place since the origin of the earth and there is no reason whatsoever to think the current climate is the optimum for human life. The commenter asserts that the term “climate change” is meaningless in an “endangerment” context and is so general as to be useless as a benchmark against which to determine allowable levels of any substance. For it to be useful, it would be necessary to decide the optimum climate for the earth, but that only makes sense in terms of defining an optimum for individual small regions; what might be construed as a good average “earth climate” might benefit one region and be deadly for another. The commenter notes that the ability to determine optimum climate control on a regional basis would require a highly unlikely agreement of science and politics and the ability to control it on a regional basis is almost nil. The commenter further notes that prior warmer periods in the Holocene are associated with improvement in human existence and expansion of habitable lands, suggesting that life has survived and thrived at substantially higher temperatures than exist at present or that are projected by the IPCC. The commenter states that if the supposedly “endangering” “climate change” means a warmer climate, there is no sound science that would suggest such a situation has anything but net benefit for mankind and other life on earth.

**Response (9-56):**

We disagree that our discussion of climate science and impacts is “undefined and unbounded.” We specifically write in the TSD that climate change “generally refers to climate change induced by human activities, including activities that emit GHGs.” Section 4 of the TSD focuses primarily on the more significant effects associated with GHGs, which is their heat-trapping ability (referred to as radiative forcing) that results in climate change. Observed climate change is reviewed, including changes in temperature, precipitation, and sea level rise, for the globe and the United States. Observed changes in climate-sensitive physical and biological systems are also addressed, as well as observed trends in extreme events. Those are the aspects of climate and climate change that are the focus of the Findings. Furthermore, in most cases, we explicitly describe the associated temporal and spatial scales when discussing climate change observations and projections.

In addition, the commenter misunderstands the role of an endangerment analysis under the Clean Air Act. The endangerment analysis under Section 202(a) does not require EPA to decide on the “optimal climate” before or as part of the endangerment analysis and does not require a finding regarding whether the current climate is optimal for human life. Section II of the Findings discusses what is meant by the endangerment provision in Section 202(a). The issue of what is an “optimal” climate could appropriately be considered in the context of developing strategies to address climate change; however, it is not relevant to making the endangerment finding under Section 202(a).

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