United States Environmental Protection Agency

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 1: General Approach to the Science and Other Technical Issues

General Approach to the Science and Other Technical Issues

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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 general approach to the science and other technical issues.

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

ANPR	Advance Notice of Proposed Rulemaking
AR4	Fourth Assessment Report
CAA	Clean Air Act
CCSP	U.S. Climate Change Science Program
CO_2	carbon dioxide
CRU	Climate Research Unit
EPA	U.S. Environmental Protection Agency
IPCC	Intergovernmental Panel on Climate Change
IQA	Information Quality Act
GHG	greenhouse gases
NIPCC	Nongovernmental International Panel on Climate Change
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
RCF	Request for Correction
SAP	synthesis and assessment product
SDWA	Safe Drinking Water Act
SPM	Summary for Policymakers
TSD	Technical Support Document
USGCRP	U.S. Global Change Research Program

1.0 General Approach to the Science and Other Technical Issues

1.1. Use of IPCC, CCSP, USGCRP, and NRC Reports as the Primary Scientific Basis

Comment (1-1):
A large number of commenters (0309.1, 0322, 0487, 0499, 0509, 0538, 0664, 0708.1, 0798, 0800.1, 0921, 1005.1, 1309.1, 1616.1, 1924, 1927, 1961, 2697.1, 2759, 2813.1, 2895, 2898.1, 2916.1, 2972.1, 3013, 3053, 3136.1, 3145.1, 3187.5, 3219.1, 3224, 3250, 3252.1, 3286.1, 3291.1, 3303, 3307.1, 3316.1, 3323.1, 3330.1, 3372.1, 3373, 3379.1, 3389, 3394.1, 3397, 3407, 3423.2, 3427.1, 3433.1, 3440.1, 3446.1, 3446.3, 3449.1, 3452.1, 3473.1, 3497.1, 3533.1, 3548.1, 3560.1, 3567.1, 3596.1, 3596.2, 3603.1, 3630.1, 3681.1, 3702.1, 3707.1, 3722, 3729.1, 3747.1, 3748.1, 3764.1, 3915, 4003, 4032, 4041.1, 4172, 4288, 4446, 4509, 4932.1, 5158, 9061.1, 9680, 9863, 9970, 10158, 10160, 10524, 10956, 11029, 11288, 11315, 11335, A18, 11410, 11466.1, and 11493) generally argued that EPA inappropriately relied almost exclusively on information from the assessment literature in developing the Technical Support Document (TSD). The commenters said that in taking this approach EPA failed to use the best available science and consider other important studies related to the topics presented in the TSD.

Response (1-1):
See Section III.A. of the findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature. Please see responses to comments in this section regarding specific issues raised by commenters related to this general comment.

EPA recognizes that scientific research is very active in many areas addressed in this document. Many commenters sent scientific articles, reports, and synthesis studies to the EPA as part of their technical and scientific comments. These submissions were categorized as either 'submitted reference material' or 'materials incorporated by reference.' Submitted reference materials are those materials that commenters provided with their comments. Materials incorporated by reference are those materials that were referred to in comments (e.g., article and report titles, book titles, or website links) but that were not submitted to EPA. EPA made every effort to retrieve and review publicly available (i.e., available free of charge via the internet or standard library access) materials incorporated by reference, particularly those in the peer reviewed literature yet not in the peer reviewed *assessment* literature.

As noted in the Foreword to each volume of the Response to Comments document, EPA did not individually respond to each submitted comment. Instead, we grouped similar comments together and addressed them:

> 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.

Similarly, we did not individually respond to each and every piece of literature submitted or incorporated by reference in comments. As explained in the Foreword:

> 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.

We categorized the literature we received for purposes of its consideration depending on whether or not it was peer-reviewed, and, if so whether it was referenced in the assessment literature summarized in the TSD. We considered such literature as having already been incorporated into the peer-reviewed assessment literature. In many cases, we note this in our response to comments, and in some cases we also discuss such literature in our responses if it provides important additional detail or information. If peer-reviewed literature was not referenced in the assessment reports, we addressed the major findings in the relevant comment response. As noted above, this does not imply that every specific piece of literature related to a particular issue was mentioned in that comment response. We also reviewed the literature that was not peer-reviewed when responding to significant comments. In many cases we discussed the findings or assertions of such literature in our comment responses, but noted that the literature was not peer-reviewed, and it was accorded less weight as a result.

The Agency recognizes the potential importance of new scientific research, and we note within this Response to Comments document where new scientific information (from either new assessment reports or individual studies) reinforce, refine, or correct specific issues summarized within the TSD. Together, the updated final TSD and EPA's responses to public comments (contained in the Findings and the 11 volumes of the Response to Comments document) constitute the scientific summary on which the Administrator has made her determination. We note that many valuable insights were obtained through the review of comments as reflected in the Findings, the TSD, and the Response to Comments document. However, we did not identify specific issues or new literature that alters, in a significant way, our understanding of how greenhouse gas emissions affect the climate and how climate change may reasonably be anticipated to endanger public health or welfare.

Comment (1-2):
A number of commenters (3324.1, 3394.1, 3429.1, 3440.1, 3481.1, 3533.1, 3579.1, 3596.1, 3707.1, 3747.1, 3764.1, 3915, 4509, 5716, 8624, 10197, 10948, and 11335) argue that the Administrator did not reference any documents in her decision-making process that offered alternative views on the scientific basis for causes of climate change. Commenters recommend that EPA provide a more complete discussion of global warming science by using information outside the assessment literature, including studies that do not support its conclusions and studies submitted to the docket through the public comment period for the Proposed Findings.

Response (1-2):
We disagree that the Administrator did not consider alternative views on climate change science and impacts. Such a contention incorrectly implies that all individual studies reviewed and incorporated into the assessments of U.S. Global Change Research Program (USGCRP), U.S. Climate Change Science Program (CCSP), Intergovernmental Panel on Climate Change (IPCC), and National Research Council (NRC) support uniform conclusions on the different elements of greenhouse gas (GHG) and climate change science, and that the many thousands of studies reviewed and reflected in these major assessment works represent a narrow view of GHG and climate change science. In fact, these assessment reports look at the range of the scientific literature without "cherry-picking" and it is EPA's conclusion that by placing primary reliance on the major assessment reports, we have ensured that the determinations are based on reports that have considered and weighed all views. EPA relied on the major peer-reviewed assessment reports in developing the TSD precisely to avoid an over-reliance on and narrow consideration of individual studies and to ensure that the Administrator's decision would be based on a comprehensive assessment of the scientific literature. EPA has determined that the approach taken provided the high level

of transparency and consistency outlined by EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency.*

Regarding the recommendation that EPA provide a more comprehensive discussion and consideration of global warming science and literature that is representative of "alternative views," we have done this through our review of comments and literature submitted, the associated revision of the TSD, and the development of the eleven volumes of the Response to Comments document. See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and previous responses in this section regarding our treatment of new and additional scientific literature provided through the public comment process. For EPA's responses to comments and literature provided on specific climate science issues in the TSD, please refer to the appropriate Response to Comment volumes.

Finally, we note that IPCC, USGCRP/CCSP, and NRC make considerable effort to ensure that their assessment reports reflect a balance of perspectives regarding the state of the science. We note that the CCSP report *Guidelines for Producing CCSP Synthesis and Assessment Products* state that the reports should "identify disparate views that have significant scientific or technical support" (CCSP, 2004). We refer commenters to Appendix B of this volume for the full listing of these *Guidelines*. Further, NRC (National Academies, 2006) report development procedures state that:

> [C]areful steps are taken to convene [report development] committees that meet the following criteria:
>
> *An appropriate range of expertise for the task.* The committee must include experts with the specific expertise and experience needed to address the study's statement of task. One of the strengths of the National Academies is the tradition of bringing together recognized experts from diverse disciplines and backgrounds who might not otherwise collaborate. These diverse groups are encouraged to conceive new ways of thinking about a problem.
>
> *A balance of perspectives*. Having the right expertise is not sufficient for success. It is also essential to evaluate the overall composition of the committee in terms of different experiences and perspectives. The goal is to ensure that the relevant points of view are, in the National Academies' judgment, reasonably balanced so that the committee can carry out its charge objectively and credibly.
>
> *Screened for conflicts of interest.* All provisional committee members are screened in writing and in a confidential group discussion about possible conflicts of interest. For this purpose, a "conflict of interest" means any financial or other interest which conflicts with the service of the individual because it could significantly impair the individual's objectivity or could create an unfair competitive advantage for any person or organization. The term "conflict of interest" means something more than individual bias. There must be an interest, ordinarily financial, that could be directly affected by the work of the committee. Except for those rare situations in which the National Academies determine that a conflict of interest is unavoidable and promptly and publicly disclose the conflict of interest, no individual can be appointed to serve (or continue to serve) on a committee of the institution used in the development of reports if the individual has a conflict of interest that is relevant to the functions to be performed."

We refer commenters to Appendix C of this volume for more information on NRC report development process. In addition, please see response to comments below regarding the IPCC report development process and procedures for ensuring a balance of perspectives.

Comment (1-3):
Several commenters (2895, 2916.1, 3145.1, 3330.1, 3497.1, 3533.1, 3630.1, 3747.1, and 10524) argue that EPA cherry-picked specific studies from the scientific literature in making its conclusions.

Response (1-3):
EPA disagrees with the comment that the Agency selectively chose studies to serve as the basis for the endangerment finding, as addressed in our response to comment 1-2.

Comment (1-4):
A large number of commenters (0245, 0636, 0655, 2898.1, 2972.1, 3145.1, 3187.1, 3214.2, 3224, 3316.1, 3323.1, 3347.4, 3360, 3373, 3394.1, 3397, 3423.2, 3427.1, 3433.1, 3440.1, 3452.1, 3482.1, 3533.1, 3597, 3630.1, 3681.1, 3722, 3729.1, 3747.1, 4003, 4041.1, 4168, 4172, 4932.1, 5158, 7020, 9060.1, 9680, 9863, 10158, 10577, 10956, 11046, and 11165) argue that EPA should have conducted its own assessment of climate data and research in developing the Proposed Findings, instead of relying on the body of assessment literature. The commenters argue that the assessment reports do not represent the best available science for a number of reasons, including inappropriate review process, failure to meet information quality guidelines, etc. Commenter 3567.1 states that for the Proposed Findings, EPA should have commissioned a body of independent scientists, engineers, and statisticians to evaluate the data, methods, and conclusions of the most important research.

Response (1-4):
See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our rationale on the approach to the scientific literature and our decision that it was not necessary nor logical for EPA to conduct an additional and separate review of the underlying climate data and research. We respond to the specific comments regarding the assessment literature (e.g., inappropriate review process) and the information quality guidelines separately below.

Comment (1-5):
A commenter (11458) argues that technically and traditionally, EPA has no purview or expertise in any of the various areas of concern cited in the Proposed Findings (i.e. storms, droughts, sea levels, crop yields, etc.). The commenter states that climate change is not an issue where there is some dose-dependent biological response to a traditional pollutant; it is a "complex physical response (complete with positive and negative feedback) by an entire planet!" The commenter states that because EPA "necessarily has limited expertise, knowledge base, or experience" in these areas, it is inappropriate for EPA to move forward with the Findings.

Response (1-5):
We disagree with the commenter's assertion that EPA does not have purview or expertise in the climate science issues discussed in the TSD. As stated in the Findings, EPA has been a very active part of the United States Government climate change research enterprise, and has taken an active role in the reviewing, writing, and approval of the USGCRP/CCSP assessment reports. EPA was the lead agency for three significant reports under the USGCRP and recently completed an assessment addressing the climate change impacts on air quality in the United States. EPA was also involved in a review of the IPCC Fourth

Assessment Report (AR4), and in particular took part in the approval of the summary for policymakers for the Working Group II volume, *Impacts, Adaptation, and Vulnerability*. We note that the specific climate science issues raised by the commenter (e.g., storms, droughts, sea levels, crop yields) and the positive/negative feedbacks are all covered in great detail within these assessment reports.

We did not develop new science to support the finding, but rather relied primarily on the conclusions of the major assessment reports of USGCRP/CCSP, IPCC, and NRC and the evaluation of the public comments received. See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the rationale for our use of the assessment literature. The use of the assessment literature capitalizes on the substantial expertise and experience that went into the development of those reports. No other source of information provides such a comprehensive and in-depth analysis across such a large body of scientific studies.

Comment (1-6):
Several commenters (3252.1, 3286.1, 3379.1, 3394.1, 3449.1, 3705.1 and 3579.1) argue that the TSD relies upon sources of information that do not adequately address the scientific issues relevant under the Clean Air Act (CAA), because the IPCC assessment reports do not address United States–specific effects in isolation, were published several years ago, and do not follow information quality guidelines.

Response (1-6):
See EPA's responses in this volume which address the comments regarding the geographic scope of IPCC's findings, the timeliness and relevancy of these reports, and their consistency with information quality guidelines.

The endangerment analysis for greenhouse gases under the CAA requires that EPA examine the extent to which the GHGs constitute the air pollution that may be reasonably anticipated to endanger public health or welfare. Please refer to Section IV.A. of the Findings ("The Air Pollution Consists of Six Key Greenhouse Gases") for the Administrator's rationale as to why the six well-mixed GHGs are defined as the air pollution for purposes of the endangerment finding under Section 202(a) of the CAA. The Findings discuss in detail the information that is relevant to the determination and how the Administrator has interpreted it in deciding whether the air pollution is reasonably anticipated to endanger public health or welfare. The scientific literature as synthesized in the TSD provides exactly the kind of information that can help inform these issues. For example, the TSD summarizes the conclusions of the assessment reports with respect to: 1) current emissions of GHG emissions; 2) how these emissions are changing the composition of the atmosphere; 3) how such changes in the atmosphere are affecting the global and regional climate; and 4) the potential impacts of such changes in climate on human health and welfare, for current and future generations. In its scope and quality, the assessment literature is relevant and appropriate for addressing the scientific issues under the CAA. Furthermore, the most recent study from the assessment literature and synthesized in the TSD was released in June, 2009. That study, Karl et al. (2009), provides both U.S.-focused information as well as re-affirms many of the key findings from the assessment literature from previous years (e.g., 2007).

Comment (1-7):
A commenter (4529) argues that the assessment reports on climate change used by EPA do not follow the scientific method and therefore provide an inappropriate basis for making an endangerment finding.

Response (1-7):

For EPA's responses to comments and literature provided on specific climate science issues in the TSD, please refer to the appropriate Response to Comment volumes.

We disagree with the commenter's general claim that the assessment reports on climate change do not follow the scientific method. EPA notes that the comment did not provide specific examples or other support for this assertion, nor did the commenter provide detail as to how the assessment literature does not follow the scientific method. We are aware of no evidence to support the commenter's charge. To the contrary, EPA has found that the assessment reports appropriately applied the scientific method by using multiple lines of climate science evidence to formulate and test hypotheses, investigate cause and effect relationships in observations, and evaluate new knowledge and advancements.

The assessment reports summarized in the TSD were prepared following rigorous and transparent processes addressing such issues as the nomination and selection of authors, the caliber of literature reflected in the assessment, and the processes for review and revision of reports. The TSD provides a general description of these procedures in Section 1(b), and Box 1.1, and our responses to specific comments on these issues are provided in Sections 1.1.1 and 1.1.2 below.

Comment (1-8):
At least one commenter (3307.1) asserts that EPA's "fail[ure] to consider reliable" scientific data made available after the publication of the Advance Notice of Proposed Rulemaking (ANPR) "flouts" the 1997 *Report of the Presidential Commission on Risk Assessment and Risk Management*. They also assert that EPA fails "to appropriately explain and incorporate relevant scientific data" as suggested by the 2009 *Presidential Memorandum on Scientific Integrity.*

Response (1-8):
EPA has considered all relevant information in the public record for this rulemaking. In its consideration, EPA has fully complied with all legal requirements, and has acted consistently with the 1997 report and 2009 Memorandum commenter cites. We note that the 1997 Report states that assessing risks should allow for "incorporation of important new information that may emerge at any stage of the risk management process." The 2009 Memorandum describes that "there should be transparency in the preparation, identification, and use of scientific and technological information in policymaking" and that the scientific information used in policy decisions "should be subject to well-established scientific processes, including peer review where appropriate." As discussed in the Findings and the Response to Comments document, EPA's approach to the science did allow for the incorporation of important new information (e.g., more recent assessment reports and public comment), and followed well-established scientific processes (e.g., the assessment reports were peer-reviewed). For a fuller discussion of the science considered, as well as the reliability of the science used, please see Section III.A. of the Findings, "The Science on Which the Decisions Are Based," and responses in this section of Volume 1.

Comment (1-9):
A commenter (0719) discusses how it is important to recognize that broad assessments, such as IPCC and CCSP reports, are too conservative in projecting climate change impacts and typically represent a kind of lowest common denominator in scientific judgment. The commenter states that EPA should not always wait for science to provide overwhelming certainty and that judgment must be exercised to avoid catastrophic risks even when the science is still incomplete.

Response (1-9):

EPA notes that through our evaluation of the scientific literature and review of public comments, we have determined that the TSD provides a sound foundation for the Administrator's endangerment analysis. We do not find the assessment reports to be too conservative. Rather, we find that they represent the best available science because they review and analyze the most recent science and evaluate uncertainties in making their conclusions. We received many comments on the legal requirements for the endangerment determination, and our response on the issue of whether the Administrator need wait until harm has occurred and the precautionary and preventive nature of the statutory language is provided in Section II. A. of the Findings, "Legal Framework for this Action."

Comment (1-10):
Several commenters (1309.1, 2750, 3187.5, 3316.1, 3394.1, 3440.1, 3548.1, 3729.1, 3747.1, 7020, and 11459) argue that EPA's external peer-review process was inadequate because the federal expert reviewers were involved with developing the IPCC and CCSP reports upon which the endangerment finding is based and therefore not objective.

Response (1-10):
EPA disagrees that review of the scientific and technical information contained in the TSD was inadequate. EPA did not develop new science as part of this action and instead summarized the existing peer-reviewed assessment literature. The decision to have 12 federal experts review the TSD was reasonable and appropriate and we disagree that the reviewers were not objective as a result of their involvement with the IPCC and CCSP. Given our approach to the scientific literature (described in Section III.A of the Findings), the purpose of the federal expert review was to ensure that the TSD accurately summarized the conclusions and associated uncertainties from the assessment reports. The federal experts were ideal candidates because they have contributed significantly to the body of climate change literature and played active roles in IPCC and CCSP—therefore making them experts on various aspects of climate science and very familiar with the underlying literature and state of the science. Furthermore, the federal climate change experts represent a range of technical specialties that span the range of topics covered in the TSD and covered by the range of topics that the Administrator needed to consider. In addition, the federal experts were not involved with developing the TSD or Findings in any way other than their review roles. Finally, we note that the federal expert review was only one part of a much larger process of developing the TSD from 2007 until the present. In addition to the three rounds of technical review by the 12 federal experts, the TSD has also gone through three rounds of internal EPA review, and two rounds of public comment.

Comment (1-11):
Two commenters (3187.5, 3729.1, and 3764.1) argue that EPA should once again review the comments received on the TSD for the (ANPR) on *Regulating Greenhouse Gases Under the Clean Air Act* regarding the use of IPCC and CCSP reports.

Response (1-11):
EPA received a number of comments specifically focused on the TSD during the 120-day public comment period for the 2008 ANPR. We reviewed these comments and revised and updated the version of the TSD that was released with the Proposed Findings on endangerment and cause or contribute in April 2009. Thus, many of the comments received on the ANPR were reflected in the version of the proposal and the TSD released in April 2009, which served as the underlying scientific and technical basis for the proposal. For the purposes of this action, EPA has once again reviewed the comments received on the ANPR regarding the use of the assessment literature in developing the TSD. Most of these comments were also submitted during the notice and 60-day comment period on the Proposed Findings,

and EPA's responses to those resubmitted comments are provided in the relevant Response to Comment volumes. EPA used an ANPR to notify the public about actions that were broadly being considered and to gather information on specific topics and the appropriate scope for potential rulemaking. It is not clear whether commenters are suggesting that existing law prescribes such a requirement; however EPA disagrees with that interpretation; there is no legal requirement for the Agency to formally respond to comments filed on the ANPR and not resubmitted during this public comment period.

Comment (1-12):
Several commenters (1924, 2898.1, 3214.1, 3330.1, 3389, 3446.2, 3560.1, 3679.1, 3748.1, 3969.1, and 4172) argue that EPA should base its endangerment finding on the recent Nongovernmental International Panel on Climate Change (NIPCC) report entitled *Climate Change Reconsidered,* instead of IPCC and CCSP reports.

Response (1-12):
EPA has reviewed and considered the NIPCC report and found that it lacks the rigorous procedures and transparency required to serve as a foundation for the endangerment analysis. A review of the NIPCC Web site indicates that the NIPCC report was developed by "two co-authors" and "35 contributors and reviewers" from "14 countries" (http://www.nipccreport.org/index.html). The organization does not appear to have established any procedures for author selection and provides no evidence that a transparent and open public or expert review was conducted. Thus, the NIPCC's approach stands in sharp contrast to the clear, transparent, and open procedures of the IPCC, CCSP, USGCRP, and NRC. Relying on the work of the major assessment reports is a sound and reasonable approach. See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and previous responses in this section regarding our treatment of new and additional scientific literature provided through the public comment process.

Although EPA sees no reason to base the endangerment analysis on the NIPCC, we did thoroughly review the report and the associated references. For EPA's responses to comments and literature provided on specific climate science issues in the TSD, including the work of the NIPCC, please refer to the appropriate Response to Comment volumes.

Comment (1-13):
Several commenters (3323.1, 4003, 4041.1, 4932.1, 5158, and 11493) attached the following reference document to their comment: *Proposed NCEE Comments on the Draft Technical Support Document for Endangerment Analysis for Greenhouse Gas Emissions Under the Clear Air Act*. This memorandum was developed by Alan Carlin in EPA's National Center for Environmental Economics. The commenters argue that EPA has accepted the findings reached by outside groups, such as IPCC and CCSP, as being correct without undertaking a careful and critical examination of the conclusions and documentation in the Carlin document. The document itself and several of the commenters suggest that EPA conduct a review of all available climate change science before moving forward with the endangerment finding.

Response (1-13):
As noted in our response to Comment 1-1, EPA has reviewed new and additional scientific literature received through public comment. This review includes the Carlin document; see the relevant Response to Comments volumes for our responses to specific scientific comments raised in that document.

See Section III.A. of the findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and EPA's decision not to conduct a new and separate

assessment of the vast body of underlying science. Finally, see Volume 11, Section 11.6.4 (Transparency) for our response to further comments regarding the Carlin document.

1.1.1 Specific Comments on EPA's Use of IPCC Reports

Comment (1-14):
Commenters (1309.1, 2813.1, 3187.5, 3330.1, 3389, 3429.1, 3440.1, 3597, 3722, 4032, 4288, 9061.1, 10196, 10197, 11288, 11315, 11409, 11046, and 11410) argue that the process and structure that IPCC employs in developing its assessment reports yields flawed reports. Specifically, several commenters (0664, 3187.5, 3250, 3330.1, 3372.1, and 4172) add that IPCC report development process is not transparent. Several of these commenters argue that not all of the authors or governments that participated in the report development process agree with all of the conclusions and that consensus was never reached. A few commenters (1309.1, 3187.5, and 11409) argue that the IPCC information quality process and system for engaging public comments is flawed, as the IPCC ignores the best available science and comments that have been submitted during public comment. Several commenters (0582, 1309.1, 3187.5, 3747.1, 4172, and 11409) argue that the review process IPCC uses is not objective, transparent to the public, or effective in ensuring that the best available information is used.

Response (1-14):
See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and previous responses in this section regarding our treatment of new and additional scientific literature provided through the public comment process. For EPA's responses to comments and literature provided on specific climate science issues in the TSD, please refer to the appropriate Response to Comment volumes.

We refer the commenters to Appendix A of this volume, which contains IPCC's *Principles Governing IPCC Work* (2006), IPCC's *Procedures for the Preparation, Review, Acceptance, Adoption, Approval, and Publication of IPCC Reports* (1999), and IPCC's *Guidance Notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties* (2004). Regarding the role of the IPCC, we quote from their *Principles* (IPCC, 2006) which states that:

> The role of the IPCC is to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation. IPCC reports should be neutral with respect to policy.

EPA has both evaluated and participated in the development and review of IPCC reports, and the IPCC process is transparent and rigorous. The IPCC ensures scientific credibility and legitimacy of its reports by fairly representing the range of scientific opinions on climate change, and the IPCC provides multiple opportunities for input from experts along the entire spectrum of opinions. Public comment periods for the three Working Group reports that compose IPCC (2007) were held to provide the international community with opportunities to review and comment. In the U.S., the CCSP announced public comment opportunities in the Federal Register and on the CCSP Web site (see list of CCSP announcements and FR notices at http://www.climatescience.gov/Library/ipcc/default.htm) for each of the IPCC (2007) Working Group reports and the Synthesis Report. CCSP also solicited nominations of author and reviewers for the IPCC (2007) reports using the same communications vehicles. Finally, IPCC provides the public with access to comments received and how they were responded to for transparency purposes. Please see the excerpt from IPCC's *Procedures* (IPCC, 1999) at the end of this response which describes in detail the

procedures for author selection, report drafting, review by governments and experts, final report preparation, and formal approval and acceptance. Appendix A of this volume contains IPCC's *Procedures* (IPCC, 1999) in its entirety.

Regarding the comment that the authors involved in producing IPCC (2007) and the governments charged with its review and acceptance did not agree with all of the conclusions, we note that the IPCC has a robust and transparent process for reaching consensus and properly documenting instances where consensus is not met. IPCC's *Principles* (IPCC, 2006) state that:

> In taking decisions, and approving, adopting and accepting reports, the Panel, its Working Groups and any Task Forces shall use all best endeavors to reach consensus. If consensus is judged by the relevant body not possible: (a) for decisions on procedural issues, these shall be decided according to the General Regulations of the WMO; (b) for approval, adoption and acceptance of reports, differing views shall be explained and, upon request, recorded. Differing views on matters of a scientific, technical or socio-economic nature shall, as appropriate in the context, be represented in the scientific, technical or socio-economic document concerned. Differences of views on matters of policy or procedure shall, as appropriate in the context, be recorded in the Report of the Session.

We disagree with the commenter that consensus was not reached amongst the governments and authors involved with the IPCC. Consistent with IPCC procedures, the Summary for Policymakers of Working Groups I, II, and III were 'approved' and the full reports of the three Working Groups were 'accepted'. IPCC *Procedures* (IPCC, 1999) define 'approval' to mean that "the material has been subjected to detailed, line by line discussion and agreement," and "acceptance" signifies that "the material has not been subject to line by line discussion and agreement, but nevertheless presents a comprehensive, objective and balanced view of the subject matter." Finally, we note that most of the commenters provided no evidence to defend their arguments. The few pieces of evidence that were submitted focused on very narrow and specific findings of studies that were referenced by IPCC (2007). For EPA's responses to these specific issues, please refer to the appropriate Response to Comment volumes.

Below, we provide excerpts of the relevant sections of the IPCC procedures (IPCC, 1999); the full text of the procedures is found in Appendix A.

Report development: To ensure objectivity, transparency, and information quality, the procedures (IPCC, 1999) clearly describe the roles and responsibilities of coordinating lead authors, lead authors, contributing authors, expert reviewers, review editors, and government reviewers in report development.

> ***4.2.1 Compilation of Lists of Coordinating Lead Authors, Lead Authors, Contributing Authors, Expert Reviewers, Review Editors and Government Focal Points***
> At the request of Working Group/Task Force Bureau Co-Chairs through their respective Working Group /Task Force Bureau, and the IPCC Secretariat, governments, and participating organizations and the Working Group/Task Force Bureau should identify appropriate experts for each area in the Report who can act as potential Coordinating Lead Authors, Lead Authors, Contributing Authors, expert reviewers or Review Editors. To facilitate the identification of experts and later review by governments, governments should also designate their respective Focal Points. IPCC Bureau Members and Members of the Task Force Bureau should contribute where necessary to identifying appropriate Coordinating Lead Authors, Lead Authors, Contributing Authors, expert reviewers, and Review Editors in cooperation with the Government Focal Points within their region to ensure an appropriate representation of experts from developing and developed countries

and countries with economies in transition. These should be assembled into lists available to all IPCC Members and maintained by the IPCC Secretariat. The tasks and responsibilities of Coordinating Lead Authors, Lead Authors, Contributing Authors, expert reviewers, Review Editors and government Focal Points are outlined in Annex 1.

4.2.2 Selection of Lead Authors

Coordinating Lead Authors and Lead Authors are selected by the relevant Working Group/Task Force Bureau, under general guidance and review provided by the Session of the Working Group or, in case of reports prepared by the Task Force on National Greenhouse Gas Inventories, the Panel, from those experts cited in the lists provided by governments and participating organizations, and other experts as appropriate, known through their publications and works. The composition of the group of Coordinating Lead Authors and Lead Authors for a section or chapter of a Report shall reflect the need to aim for a range of views, expertise and geographical representation (ensuring appropriate representation of experts from developing and developed countries and countries with economies in transition). There should be at least one and normally two or more from developing countries. The Coordinating Lead Authors and Lead Authors selected by the Working Group/Task Force Bureau may enlist other experts as Contributing Authors to assist with the work.

At the earliest opportunity, the IPCC Secretariat should inform all governments and participating organizations who the Coordinating Lead Authors and Lead Authors are for different chapters and indicate the general content area that the person will contribute to the chapter.

4.2.3 Preparation of Draft Report

Preparation of the first draft of a Report should be undertaken by Coordinating Lead Authors and Lead Authors. Experts who wish to contribute material for consideration in the first draft should submit it directly to the Lead Authors. Contributions should be supported as far as possible with references from the peer-reviewed and internationally available literature, and with copies of any unpublished material cited. Clear indications of how to access the latter should be included in the contributions. For material available in electronic format only, a hard copy should be archived and the location where such material may be accessed should be cited.

Lead Authors will work on the basis of these contributions, the peer-reviewed and internationally-available literature, including manuscripts that can be made available for IPCC review and selected non-peer review literature according to Annex 2 and IPCC Supporting Material (see section 6). Material which is not published but which is available to experts and reviewers may be included provided that its inclusion is fully justified in the context of the IPCC assessment process (see Annex 2).

In preparing the first draft, and at subsequent stages of revision after review, Lead Authors should clearly identify disparate views for which there is significant scientific or technical support, together with the relevant arguments. Technical summaries provided will be prepared under the leadership of the Working Group/Task Force Bureau.

Review: IPCC's *Procedures* prescribe that "Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information." The following excerpts from IPCC's *Procedures* describe in detail the steps, requirements, and objectives of the review process.

4.1 Introduction to Review Process

The review process generally takes place in three stages: expert review of IPCC Reports, government/expert review of IPCC Reports, government review of the Summaries for Policymakers, Overview Chapters and/or the Synthesis Report. Working Group/Task Force Bureau Co-Chairs should aim to avoid (or at least minimize) the overlap of government review periods for different IPCC Reports and with Sessions of the Conference of Parties of the United Nations Framework Convention of Climate Change and its subsidiary bodies.

Expert review should normally be eight weeks, but not less than six weeks, except to the extent decided by the Panel. Government and government/expert reviews should not be less than eight weeks, except to the extent decided by the Panel.

All written expert, and government review comments will be made available to reviewers on request during the review process and will be retained in an open archive in a location determined by the IPCC Secretariat on completion of the Report for a period of at least five years….

…4.2.4 Review

Three principles governing the review should be borne in mind. First, the best possible scientific and technical advice should be included so that the IPCC Reports represent the latest scientific, technical and socio-economic findings and are as comprehensive as possible.

Secondly, a wide circulation process, ensuring representation of independent experts (i.e. experts not involved in the preparation of that particular chapter) from developing and developed countries and countries with economies in transition should aim to involve as many experts as possible in the IPCC process. Thirdly, the review process should be objective, open and transparent.

To help ensure that Reports provide a balanced and complete assessment of current information, each Working Group/Task Force Bureau should normally select two Review Editors per chapter (including the executive summaries) and per technical summary of each Report.

Review Editors should normally consist of a member of the Working Group/Task Force Bureau, and an independent expert based on the lists provided by governments and participating organizations. Review Editors should not be involved in the preparation or review of material for which they are an editor. In selecting Review Editors, the Bureau should select from developed and developing countries and from countries with economies in transition, and should aim for a balanced representation of scientific, technical, and socio-economic views.

4.2.4.1 First Review (by Experts)

First draft Reports should be circulated by Working Group/Task Force Bureau Co-Chairs for review by experts selected by the Working Group/Task Force Bureau and, in addition, those on the lists provided by governments and participating organizations, noting the need to aim for a range of views, expertise, and geographical representation. The review circulation should include:

- Experts who have significant expertise and/or publications in particular areas covered by the Report.

- Experts nominated by governments as Coordinating Lead Authors, Lead Authors, contributing authors or expert reviewers as included in lists maintained by the IPCC Secretariat.
- Expert reviewers nominated by appropriate organizations.

The first draft Reports should be sent to Government Focal Points, for information, along with a list of those to whom the Report has been sent for review in that country.

The Working Group/Task Force Bureau Co-Chairs should make available to reviewers on request during the review process specific material referenced in the document being reviewed, which is not available in the international published literature.

Expert reviewers should provide the comments to the appropriate Lead Authors through the relevant Working Group/Task Force Bureau Co-Chairs with a copy, if required, to their Government Focal Point.

Coordinating Lead Authors, in consultation with the Review Editors and in coordination with the respective Working Group/Task Force Bureau Co-Chairs and the IPCC Secretariat, are encouraged to supplement the draft revision process by organizing a wider meeting with principal Contributing Authors and expert reviewers, if time and funding permit, in order to pay special attention to particular points of assessment or areas of major differences.

4.2.4.2 Second Review (by Governments and Experts)
A revised draft should be distributed by the appropriate Working Group/Task Force Bureau Co-chairs or through the IPCC Secretariat to governments through the designated Government Focal Points, and to all the coordinating lead authors, lead authors and contributing authors and expert reviewers.

Governments should send one integrated set of comments for each Report to the appropriate Working Group/Task Force Bureau Co-chairs through their Government Focal Points.

Non-government reviewers should send their further comments to the appropriate Working Group/Task Force Bureau Co-Chairs with a copy to their appropriate Government Focal Point.

Acceptance and Approval: Finally, IPCC's *Procedures* (1999) describe the acceptance and approval procedures to ensure that the development of the assessment reports has been completed in a way which maximizes objectivity, transparency, quality, and utility:

4.2.5 Preparation of Final Draft Report
Preparation of a final draft Report taking into account government and expert comments for submission to a Session of a Working Group or, in case of a report prepared by the Task Force on National Greenhouse Gas Inventories, of the Panel for acceptance should be undertaken by Coordinating Lead Authors and Lead Authors in consultation with the Review Editors. If necessary, and timing and funding permitting, a wider meeting with principal Contributing Authors and expert and government reviewers is encouraged in order to pay special attention to particular points of assessment or areas of major differences. It is important that Reports describe different (possibly controversial) scientific, technical, and socio-economic views on a subject, particularly if they are

relevant to the policy debate. The final draft should credit all Coordinating Lead Authors, Lead Authors, Contributing Authors, reviewers and Review Editors by name and affiliation (at the end of the Report).

4.3 Approval and Acceptance of Summaries for Policymakers and Adoption of Overview Chapters of Methodology Reports Related to National Greenhouse Gas Inventories

Summary sections of Reports approved by the Working Groups and accepted by the Panel will principally be the Summaries for Policymakers, prepared by the respective Working Groups of their full scientific, technical and socio-economic assessments, and Summaries for Policymakers of Special Reports prepared by the Working Groups. The Summaries for Policy Makers should be subject to simultaneous review by both experts and governments and to a final line by line approval by a Session of the Working Group. Responsibility for preparing first drafts and revised drafts of Summaries for Policymakers, lies with the respective Working Group Co-Chairs. The Summaries for Policymakers should be prepared concurrently with the preparation of the main Reports.

Approval of the Summary for Policymakers at the Session of the Working Group, signifies that it is consistent with the factual material contained in the full scientific, technical and socioeconomic assessment or Special Report accepted by the Working Group. Coordinating lead authors may be asked to provide technical assistance in ensuring that consistency has been achieved. These Summaries for Policymakers should be formally and prominently described as:

> "A Report of [Working Group X of] the Intergovernmental Panel on Climate Change."

For a Summary for Policymakers approved by a Working Group to be endorsed as an IPCC Report, it must be accepted at a Session of the Panel. Because the Working Group approval process is open to all governments, Working Group approval of a Summary for Policymakers means that the Panel cannot change it. However, it is necessary for the Panel to review the Report at a Session, note any substantial disagreements, (in accordance with Principle 10 of the Principles Governing IPCC Work) and formally accept it.

As demonstrated by these procedures, IPCC assessment reports are developed following well-established and comprehensive guidelines. As an example of how this process works in practice, the introduction to IPCC (2007b), the working group report on impacts, adaptation and vulnerability, summarized their process as follows:

> In total, the Working Group II Fourth Assessment involved 48 Coordinating Lead Authors (CLAs), 125 Lead Authors (LAs), and 45 Review Editors (REs), drawn from 70 countries. In addition, there were 183 Contributing Authors and 910 Expert Reviewers.
>
> Each chapter in the Working Group II Fourth Assessment had a writing team of two to four CLAs and six to nine LAs. Led by the CLAs, it was the responsibility of this writing team to produce the drafts and finished version of the chapter. Where necessary, they could recruit Contributing Authors to assist in their task. Three drafts of each chapter were written prior to the production of the final version. Drafts were reviewed in two separate lines of review, by experts and by governments. It was the role of the REs (two

> to three per chapter) to ensure that the review comments were properly addressed by the authors.
>
> The authors and REs were selected by the Working Group II Bureau from the lists of experts nominated by governments. Due regard was paid to the need to balance the writing team with proper representation from developing and developed countries, and Economies in Transition. In the review by experts, chapters were sent out to experts, including all those nominated by governments but not yet included in the assessment, together with scientists and researchers identified by the Working Group II Co-Chairs and Vice-Chairs from their knowledge of the literature and the global research community.

The evidence is clear that the IPCC's procedures are sufficient and effective for ensuring quality, transparency, and consideration of multiple and diverse perspectives. Because the assessment reports EPA used in developing the TSD represent the best available science, and because supporting studies were conducted in accordance with sound and objective scientific practices, were peer reviewed, and adhered to standards of quality based on objectivity, utility, and integrity, we find that IPCC's information quality process is consistent with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency.*

The U.S. Government participated fully in the development, review, and ultimate acceptance and approval of IPCC (2007). As stated on the USGCRP's Web site: "When governments accept the IPCC reports and approve their Summary for Policymakers, they acknowledge the legitimacy of their scientific content" (http://www.globalchange.gov/publications/reports/ipcc-reports).

Comment (1-15):
A commenter (3303) argues that the IPCC AR4 relied upon non-peer reviewed, unsupportable studies rather than peer-reviewed literature.

Response (1-15):
The IPCC *Procedures* (IPCC, 1999) used in preparing its assessment reports are described above and can be viewed in Appendix A of this volume. The IPCC provides a robust process for ensuring that the best available scientific information is used in their assessment report development process. The IPCC (2007) relied almost exclusively on peer-reviewed, published information and we note that IPCC procedures require reliance on peer-reviewed literature except in specific instances. IPCC's guidelines state that "Contributions should be supported as far as possible with references from the peer-reviewed and internationally available literature…" (IPCC, 1999). Limited unpublished material was included only if it was justified in the context of the IPCC assessment process and completely accessible.

Annex 2 of the IPCC procedures (IPCC, 1999) provides the following guidelines for using non-published sources in assessment reports:

> Because it is increasingly apparent that materials relevant to IPCC Reports, in particular, information about the experience and practice of the private sector in mitigation and adaptation activities, are found in sources that have not been published or peer-reviewed (e.g., industry journals, internal organizational publications, non-peer reviewed reports or working papers of research institutions, proceedings of workshops etc) the following additional procedures are provided. These have been designed to make all references used in IPCC Reports easily accessible and to ensure that the IPCC process remains open and transparent.

1. Responsibilities of Coordinating, Lead and Contributing Authors
Authors who wish to include information from a non-published/non-peer-reviewed source are requested to:
a. Critically assess any source that they wish to include. This option may be used for instance to obtain case study materials from private sector sources for assessment of adaptation and mitigation options. Each chapter team should review the quality and validity of each source before incorporating results from the source into an IPCC Report.
b. Send the following materials to the Working Group/Task Force Bureau Co-Chairs who are coordinating the Report:

- One copy of each unpublished source to be used in the IPCC Report
- The following information for each source:
- Title
- Author(s)
- Name of journal or other publication in which it appears, if applicable
- Information on the availability of underlying data to the public
- English-language executive summary or abstract, if the source is written in a non-English language
- Names and contact information for 1-2 people who can be contacted for more information about the source.

2. Responsibilities of the Review Editors
The Review Editors will ensure that these sources are selected and used in a consistent manner across the Report.

These procedures establish that the IPCC rely almost exclusively on peer-reviewed literature. The procedures also provide a comprehensive, transparent and robust process in the rare circumstances where unpublished or non-peer reviewed material is used. Further, EPA's review of the studies included in the IPCC assessment reports, which we used in developing the TSD, confirms that the use of non-peer-reviewed literature was predominantly associated with the report of IPCC Working Group III ("Mitigation of Climate Change") and the treatment of adaptation issues in IPCC Working Group II, two areas not assessed by the Administrator in this action. See Section III.C, "Adaptation and Mitigation," of the Findings for a discussion on the treatment of adaptation and mitigation.

The commenter describes two pieces of literature that were referenced by IPCC but not published in peer-reviewed journals: 1) a natural catastrophes report by Munich Re (2000) that was cited in IPCC Third Assessment Report (IPCC, 2001), and 2) a paper on trends in weather-related catastrophes by Muir-Wood et al. (2006). The identification of only two examples out of the thousands of references cited in the IPCC (2000) and (2007) reports provides more support for the rigor of the IPCC process. Further, these specific studies were neither the central nor sole evidence used in forming the broader conclusions of the IPCC; such broader conclusions are based on multiple lines of evidence and peer-reviewed literature.

Comment (1-16):
Several commenters (e.g., 3680.1, 4101, 4143, 7392, 8318, 8874, 10156) voice their support for EPA's reliance on recently published, consensus-based, peer-reviewed assessments and reports of the IPCC, CCSP, and the National Academy of Sciences. Some commenters (9568, 9633) provided additional supportive references, citing Dr. James Hansen, Lord Nicholas Stern, Rajendra Pachauri, James Lovelock, and Stephen Hawking. One commenter (9749) referenced a report from the New Jersey Board of Public Utilities on climate and energy detailing the impacts of climate change on the quality of life in New Jersey.

Response (1-16):
We agree that reliance on the peer-reviewed assessment literature is appropriate and reasonable. We have closely reviewed and considered the additional studies submitted by the commenter and we find that these materials are consistent with the information summarized in the TSD. For example, the New Jersey report states that "Not only does climate change threaten New Jersey's shoreline and ecology, but the socioeconomic impacts of global warming stand to be profound and costly."

Comment (1-17):
Several commenters (1005.1, 3303, 3330.1, 3427.1, 3446.3, and 3567.1) argue that many of IPCC's conclusions are distorted, misleading, or incorrect. A number of commenters (0487, 1927, 3013, 3219.1, 3303, 3567.1, 3707.1, 3764.1, and 4509) state that IPCC reports are based on poor-quality science.

Response (1-17):
See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and previous responses in this section regarding our treatment of new and additional scientific literature provided through the public comment process. For EPA's responses to comments and literature provided on specific climate science issues in the TSD, please refer to the appropriate Response to Comment volumes.

We note that this response addresses the broad assertion made by commenters with regard to IPCC's conclusions being distorted, misleading, or incorrect. Several of these commenters also provided specific reasons for why these conclusions are claimed to be distorted, misleading, or incorrect (e.g., due to inappropriate review processes) and we respond to these specific comments in the relevant volumes of this Response to Comments document.

As a general matter, we disagree that the IPCC's conclusions are distorted, misleading, or incorrect or that the IPCC relies on poor-quality science. As thoroughly discussed in our response to comment 1-14, the IPCC process for preparation and review of its reports demonstrate a formal and sustained commitment to transparency and rigor in report development, review, and acceptance and approval. The assessment reports we used in developing the TSD represent the best available science and supporting studies conducted in accordance with sound and objective scientific practices, are peer reviewed, and adhere to standards of quality based on objectivity, utility, and integrity.

Comment (1-18):
Several commenters (2679.1, 2972.1, 3136.1, 3323.1, 3327.1, 3330.1, 3347.4, 3394.1, 3794.1, 4003, 4041.1, 4932.1, 5158, and 11046) argue that the IPCC reports are inappropriate for use in the endangerment finding because the underlying studies are out of date and that major scientific findings have appeared since IPCC (2007) that have changed the science community's understanding of what is presented in that report.

Response (1-18):
See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and previous responses in this section regarding our treatment of new and additional scientific literature provided through the public comment process.

As part of this final Action, EPA updated the TSD to reflect new assessment reports published since release of the Proposed Findings and the TSD's April 2009 version. In particular, we have revised the TSD to incorporate the findings of the latest assessment (released June 16, 2009) of the USGCRP. This

new study does not differ markedly from the fundamental conclusions of the IPCC. In fact, this most recent USGCRP assessment report integrates newer literature and builds on the key findings from the IPCC, USGCRP, CCSP, and NRC assessments to reach similar, and in some cases, stronger conclusions. In addition, the TSD incorporates up-to-date observational data for a number of key climate variables from the National Oceanic and Atmospheric Administration (NOAA), and the most up-to-date emissions data from EPA's annual *Inventory of U.S. Greenhouse Gas Emissions and Sinks*, published in April 2009. We do not agree that it is inappropriate for the Administrator to use the IPCC assessment reports as part of the foundation for the Administrator's endangerment determination. The assessment reports discussed in the TSD do reflect the state of science on climate change and are not out of date. EPA has determined that the approach taken provided the high level of transparency and consistency outlined by EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency.*

EPA's responses to comments and literature submitted on specific climate science issues in the TSD are provided in the appropriate Response to Comment volumes. These responses indicate where new scientific information (from either new assessment reports or individual studies) reinforce, refine, or correct specific issues. EPA has addressed all significant scientific findings identified and submitted by commenters that have appeared since the IPCC (2007).

Based on our review of the studies submitted during the public comment process as well as additional peer-reviewed literature published since IPCC's Fourth Assessment Report, we find that IPCC's conclusions are still accurate representations of the scientific community's understanding of the science. Much of the more recent literature reaffirms IPCC's conclusions, and even strengthens the confidence in key issues.

Comment (1-19):
Several commenters (3187.5, 3440.1, 4288, 9636, 9970, 11288, 11315, and 11409) argue that IPCC reports, including the Summary for Policymakers (SPM), are not appropriate resources for the endangerment finding because IPCC tasks government politicians with creating the documents instead of climate scientists.

Response (1-19):
We refer the commenters to previous responses to comments in this section regarding IPCC's report development process.

EPA disagrees with this comment for several reasons. First, the IPCC has clear procedures in place for the preparation of the SPM, which state that: "Summary sections of Reports approved by the Working Groups and accepted by the Panel will principally be the Summaries for Policymakers, prepared by the respective Working Groups of their full scientific, technical and socio-economic assessments, and Summaries for Policymakers of Special Reports prepared by the Working Groups" (IPCC, 1999). These procedures require the SPM to be drafted by teams of authors from the various underlying IPCC chapters, and the commenter has provided no information that demonstrates that "government politicians" were involved in the drafting.

Second, the IPCC procedures build in processes to ensure that the findings of the SPM are consistent with the underlying IPCC reports: "Approval of the Summary for Policymakers at the Session of the Working Group, signifies that it is consistent with the factual material contained in the full scientific, technical and socioeconomic assessment or Special Report accepted by the Working Group. Coordinating lead authors may be asked to provide technical assistance in ensuring that consistency has been achieved" (IPCC,

1999). These procedures avoid the apparent concern of the commenter that an SPM could be inconsistent with the findings of the body of an IPCC report.

Third, in developing the TSD as the scientific basis for the Administrator's endangerment analysis, EPA relied predominantly on the full reports of IPCC (2007a, 2007e), not on the SPMs. Findings from the SPMs were only used to provide overarching discussions of climate science and impacts throughout the TSD Sections.

Fourth, IPCC procedures and principles (see our response to comment 1-14 and Appendix A) demonstrate that in making decisions and approving, adopting, and accepting reports, the Panel, its Working Groups and any Task Forces shall use all best endeavors to reach consensus. In those cases where consensus is not reached, IPCC procedures require that the differing views shall be explained and, upon request, recorded. These procedures also specify that differing views on matters of a scientific, technical, or socio-economic nature shall, as appropriate in the context, be represented in the scientific, technical, or socio-economic document concerned. We note that neither SPM for IPCC (2007a) or IPCC (2007e) indicate that consensus was not reached.

Any statement from an IPCC SPM used within the TSD is fully supported by the underlying, full report of the IPCC; all of the material taken from SPM Sections of these reports is supported by information in the underlying chapters. Commenters also have not identified any such statement that is inconsistent with this.

Comment (1-20):
Several commenters (1961, 3053, 3707.1, 3722, 3722.9, 3187.5, 7029, and 10196) argue that the authors involved in developing and reviewing IPCC (2007) all share the same views regarding climate change science, and that alternative perspectives were not incorporated into the process. These commenters also state that the IPCC authors commonly collaborate on research, and therefore were not capable of objectively reviewing and editing the content of IPCC (2007). A commenter (3187.5) specifically mentioned that IPCC's authors on the climate modeling chapters do not represent a diversity of perspectives, as many of them work at the same research institutes and/or collaborate with each other.

Response (1-20):
We refer the commenters to previous responses to comments in this section (1-14, 1-15, 1-17, 1-18, 1-19) regarding IPCC's report development process.

EPA has carefully reviewed the IPCC procedures and does not agree with this comment. For an overview of the IPCC procedures, please see the Introduction of the TSD. As noted previously, Section 1(b) and Box 1.1 of the TSD provide a general description of the IPCC's procedures. Both within the United States and within the IPCC, the objective was to ensure that the authors represented a range of perspectives and views. We note that the majority of these comments provide no specific evidence for their general assertion. Only one commenter (3187.5) provided a specific argument—a critique of the range of perspectives among the authors on Chapter 9 ("Understanding and Attributing Climate Change") of WGI (IPCC, 2007a). We acknowledge that some of the 53 Chapter 9 authors are associated with the same research institutes; however, we find that the majority of them do not frequently collaborate on research. In fact, many of the research institutes, such as National Center for Atmospheric Research and the Hadley Center, work on their own climate modeling studies independently of other programs. Further, we find that the authors from Chapter 9 come from 31 different organizations and from over 15 different countries. In a field as small and technical as climate modeling, we conclude that representation from 31 organizations sufficiently provides a range of perspectives. Even the commenter acknowledges this in their statement that "53 authors of chapter 9 came from just 31 organizations."

The commenters also claim that the IPCC authors commonly collaborate on research and therefore are not objective. This claim is not supported by the evidence. Each IPCC report is developed by a team of authors, broken down into independent groups focusing on specific chapters, under the leadership of the Working Group Chairs and Convening Lead Authors. Please see the excerpt from IPCC's Procedures (IPCC, 1999) at the end of this comment, which discusses the tasks and responsibilities for lead authors, coordinating lead authors, contributing authors, expert reviewers, and government reviewers. In addition to what is stated in this excerpt, the *Procedures* (IPCC, 1999) state that:

> Coordinating Lead Authors and Lead Authors are selected by the relevant Working Group/Task Force Bureau, under general guidance and review provided by the Session of the Working Group….The composition of the group of Coordinating Lead Authors and Lead Authors for a section or chapter of a Report shall reflect the need to aim for a range of views, expertise and geographical representation (ensuring appropriate representation of experts from developing and developed countries and countries with economies in transition). There should be at least one and normally two or more from developing countries.

More than 500 authors and 2,000 reviewers (representing over 100 nations) were involved with developing IPCC (2007), and they offered a diversity of perspectives related to climate change science both during the drafting of the reports and during multiple comment opportunities. We find that the level of collaboration amongst the hundreds of authors is low and that the examples of collaborative efforts (e.g., co-authorship of studies) provided by commenters are isolated cases—especially when considering the large number of available studies upon which the assessment reports rely and the hundreds of authors who developed them. Further, there is no evidence provided that supports the claim that collaboration among a small number of the authors prevented the incorporation of a range of perspectives and alternative views or biased the conclusions.

In addition, Review Editors oversee the integrity of the response to comment processes for all IPCC reports. IPCC's guidelines for report development (IPCC, 1999) state that:

> Three principles governing the review should be borne in mind. First, the best possible scientific and technical advice should be included so that the IPCC Reports represent the latest scientific, technical and socio-economic findings and are as comprehensive as possible. Secondly, a wide circulation process, ensuring representation of independent experts (i.e. experts not involved in the preparation of that particular chapter) from developing and developed countries and countries with economies in transition should aim to involve as many experts as possible in the IPCC process. Thirdly, the review process should be objective, open and transparent.
>
> To help ensure that Reports provide a balanced and complete assessment of current information, each Working Group/Task Force Bureau should normally select two Review Editors per chapter (including the executive summaries) and per technical summary of each Report.
>
> Review Editors should normally consist of a member of the Working Group/Task Force Bureau, and an independent expert based on the lists provided by governments and participating organizations. Review Editors should not be involved in the preparation or review of material for which they are an editor. In selecting Review Editors, the Bureau should select from developed and developing countries and from countries with

economies in transition, and should aim for a balanced representation of scientific, technical, and socio-economic views.

We do not find merit in the argument that the IPCC procedures or the IPCC authors lack objectivity or integrity. Please see the relevant Response to Comment volumes for our responses to any specific technical comments provided on the IPCC findings or processes.

The following is an excerpt from IPCC's *Procedures* (IPCC, 1999) describing the tasks and responsibilities for lead authors, coordinating lead authors, contributing authors, expert reviewers, and government reviewers. Appendix A of this volume contains IPCC's *Procedures* (IPCC, 1999) in its entirety.

1. LEAD AUTHORS
Function:
To be responsible for the production of designated sections addressing items of the work program on the basis of the best scientific, technical and socio-economic information available.

Comment:
Lead Authors will typically work as small groups which have responsibility for ensuring that the various components of their sections are brought together on time, are of uniformly high quality and conform to any overall standards of style set for the document as a whole.

The task of Lead Authors is a demanding one and in recognition of this the names of Lead Authors will appear prominently in the final Report. During the final stages of Report preparation, when the workload is often particularly heavy and when Lead Authors are heavily dependent upon each other to read and edit material, and to agree to changes promptly, it is essential that the work should be accorded the highest priority.

The essence of the Lead Authors' task is synthesis of material drawn from available literature as defined in Section 4.2.3. Lead Authors, in conjunction with Review Editors, are also required to take account of expert and government review comments when revising text. Lead Authors may not necessarily write original text themselves, but they must have the proven ability to develop text that is scientifically, technically and socio-economically sound and that faithfully represents, to the extent that this is possible, contributions by a wide variety of experts. The ability to work to deadlines is also a necessary practical requirement. Lead Authors are required to record in the Report views which cannot be reconciled with a consensus view but which are nonetheless scientifically or technically valid.

Lead Authors may convene meetings with Contributing Authors, as appropriate, in the preparations of their sections or to discuss expert or government review comments and to suggest any workshops or expert meetings in their relevant areas to the Working Group/Task Force Bureau Co-Chairs. The names of all Lead Authors will be acknowledged in the Reports.

2. COORDINATING LEAD AUTHORS
Function:
To take overall responsibility for coordinating major sections of a Report

Comment:
Coordinating Lead Authors will be Lead Authors with the added responsibility of ensuring that major sections of the Report are completed to a high standard, are collated and delivered to the Working Group/Task Force Bureau Co-Chairs in a timely manner and conform to any overall standards of style set for the document.

Coordinating Lead Authors will play a leading role in ensuring that any crosscutting scientific or technical issues which may involve several sections of a Report are addressed in a complete and coherent manner and reflect the latest information available.

The skills and resources required of Coordinating Lead Authors are those required of Lead Authors with the additional organizational skills needed to coordinate a section of a Report.

The names of all Coordinating Lead Authors will be acknowledged in the Reports.

3. CONTRIBUTING AUTHORS
Function:
To prepare technical information in the form of text, graphs or data for assimilation by the Lead Authors into the draft section.

Comment:
Input from a wide range of contributors is a key element in the success of IPCC assessments, and the names of all contributors will be acknowledged in the Reports. Contributions are sometimes solicited by Lead Authors but unprompted contributions are encouraged.

Contributions should be supported as far as possible with references from the peer reviewed and internationally available literature, and with copies of any unpublished material cited; clear indications of how to access the latter should be included in the contributions. For material available in electronic format only, the location where such material may be accessed should be cited.

Contributed material may be edited, merged and if necessary, amended, in the course of developing the overall draft text.

4. EXPERT REVIEWERS
Function:
To comment on the accuracy and completeness of the scientific/technical/socio-economic content and the overall scientific/technical/socio-economic balance of the drafts.

Comment:
Expert reviewers will comment on the text according to their own knowledge and experience. They may be nominated by Governments, national and international organizations, Working Group/Task Force Bureau/Lead Authors and Contributing Authors.

5. REVIEW EDITORS
Function:
Review Editors will assist the Working Group/Task Force Bureau in identifying reviewers for the expert review process, ensure that all substantive expert and

government review comments are afforded appropriate consideration, advise lead authors on how to handle contentious/controversial issues and ensure genuine controversies are reflected adequately in the text of the Report.

Comment:
There will be one or two Review Editors per chapter (including their executive summaries) and per technical summary. In order to carry out these tasks, Review Editors will need to have a broad understanding of the wider scientific and technical issues being addressed. The workload will be particularly heavy during the final stages of the Report preparation. This includes attending those meetings where writing teams are considering the results of the two review rounds. Review Editors are not actively engaged in drafting Reports and cannot serve as reviewers of those chapters of which they are Authors. Review Editors can be members of a Working Group/Task Force Bureau or outside experts agreed by the Working Group/Task Force Bureau.

Although responsibility for the final text remains with the Lead Authors, Review Editors will need to ensure that where significant differences of opinion on scientific issues remain, such differences are described in an annex to the Report. Review Editors must submit a written report to the Working Group Sessions or the Panel and where appropriate, will be requested to attend Sessions of the Working Group and of the IPCC to communicate their findings from the review process and to assist in finalizing the Summary for Policymakers, Overview Chapters of Methodology Reports and Synthesis Reports. The names of all Review Editors will be acknowledged in the Reports.

6. GOVERNMENT FOCAL POINTS
Function:
To prepare and update the list of national experts as required to help implement the IPCC work program, and to arrange the provision of integrated comments on the accuracy and completeness of the scientific and/or technical content and the overall scientific and/or technical balance of the drafts.

Comment:
Government review will typically be carried out within and between a number of Departments and Ministries.

For administrative convenience, each government and participating organization should designate one Focal Point for all IPCC activities, provide full information on this Focal Point to the IPCC Secretariat and notify the Secretariat of any changes in this information. The Focal Point should liaise with the IPCC Secretariat regarding the logistics of the review process(es). Of particular importance is the full exchange of information.

Comment (1-21):
Several commenters (0800.1, 3440.1, 4528, 4666, 4670, and 4766) argue that IPCC relies too heavily on models and simulation tools in making conclusions and that climate models are inappropriate tools for an endangerment analysis.

Response (1-21):
EPA received many specific comments on the use of models and simulation tools in the context of the TSD and as support for the endangerment analysis. Please see the relevant Response to Comment

volumes for our responses to these specific comments, particularly Volume 4, which focuses specifically on climate models and highlights other lines of evidence relevant to particular conclusions.

As a general matter, we find that IPCC's reliance on models to evaluate the key elements of climate change science is appropriate and that these tools help scientists better understand the many climatic, geological, chemical, and biological systems involved with climate change. Furthermore, we find that the IPCC carefully documents and discusses uncertainties, assumptions, and limitations of the models used, and we have incorporated this information into the TSD. The climate models and other models used in the IPCC report meet the standards of the best available science available: they have been validated and compared against theory, observation, and other models. The models are routinely used in scientific practice throughout the country and the world. The TSD appropriately represents both the strengths and limitations of the models, as determined by the major assessment reports.

In addition, it is important to recognize that the most important conclusions regarding climate science and impacts are based on numerous independent sources of information, including observations of the changing GHG composition of the atmosphere, observed changes in the climate system, and observed changes to physical and biological systems.

Comment (1-22):
Several commenters (3394.1, 3440.1, 3722, and 4509) specifically state that in developing the TSD, EPA did not give proper consideration to the numerous uncertainties in IPCC's findings.

Response (1-22):
Please see Section 1.2 of this document for responses to these comments and for a general discussion of uncertainty. In addition, please see the relevant Response to Comment volumes for our responses on the treatment of uncertainty regarding specific issues in the TSD.

Comment (1-23):
Several commenters (3394.1, 3705.1, 3747.1, and 3482.1) argue that IPCC assessments are devoted primarily to global effects and global emissions and are therefore inappropriate for describing the observed and projected impacts of climate change in the United States necessary for an endangerment finding.

Response (1-23):
We do not agree that IPCC reports are inappropriate for an assessment of climate impacts in the United States. As explained in the TSD, the IPCC (2007b) includes a chapter on North America, which focuses on impacts, adaptation and vulnerability in the United States and Canada. We find that the North America chapter draws from many individual studies on the United States and provides United States–specific findings, many of which are included in the TSD. We also note that IPCC (2007) contains a chapter on small islands with specific findings for U.S. islands and territories, along with a chapter on polar regions which includes Alaska-specific discussions. Where the TSD references IPCC conclusions for global or regional areas that include the United States and other areas, we ensured that the conclusions were applied appropriately and accurately. Perhaps more importantly, we ensured that the TSD did not summarize conclusions from the assessment literature which did not apply to or were not appropriate for the United States. We received comments of this nature regarding specific climate science issues and our responses can be seen in the relevant volumes of this Response to Comments document. Our approach is entirely reasonable and consistent with how IPCC intended the conclusions to be used.

Finally, we note that the TSD summarizes important findings and conclusions from reports of the USGCRP and CCSP, which focus almost exclusively on the United States. In particular, we updated the TSD to reflect the findings of the June 2009 USGCRP assessment report, by adding additional information to the sectoral chapters in Section IV of the TSD and a new section (15) on U.S. regional climate change impacts.

Please see other relevant Response to Comment volumes for our response to specific comments related to the TSD's discussion of particular U.S. climate impacts, and Volume 9 for our response to comments on the global and domestic scope of the endangerment finding.

Comment (1-24):
Several commenters (3287.1, 3291.1, 3379.1, 3394.1, 3407, 3482.1, and 3705.1) state that EPA's adoption of the IPCC's regional analysis of North American impacts, including projections for changes in temperature, precipitation, and sea level rise, cannot substitute for a U.S.–specific analysis because the IPCC's assessment failed to distinguish adequately between U.S. and Canadian effects.

Response (1-24):
Please refer to the previous comment for our response regarding the applicability of the IPCC discussion of climate impacts to the United States.

1.1.2 Specific Comments on EPA's Use of CCSP and USGCRP Reports

Comment (1-25):
A commenter (3765.1) encourages EPA to refer to the findings of the USGCRP's assessment report *Global Climate Change Impacts in the United States.*

Response (1-25):
The TSD has been revised to cite the final version of this report (Karl et al., 2009).

We find that this report and the other scientific assessments of the IPCC, CCSP, and NRC represent the best reference materials for determining the general state of knowledge on the scientific and technical issues before the agency in informing an endangerment decision. The *Guidelines for Producing CCSP Synthesis and Assessment Products* (CCSP, 2004) state that:

> Independent scientific judgment should serve as the guiding force in preparing the products so they are credible.
> Scientists, users, and other stakeholders should jointly determine the scope of the products so the topics covered are well defined and the information provided is relevant to the needs expressed.
> The process of preparing the products should be open at every step so the products have legitimacy (i.e., are perceived to have been prepared fairly).

The process used by USGCRP/CCSP in developing their assessment reports is robust, transparent, and objective. We refer the commenters to Appendix B of this volume, which contains the following CCSP documents: 1) *Guidelines for Producing CCSP Synthesis and Assessment Products* (2004), 2) a CCSP memo on *Clarification of Review and Clearance Process for CCSP Synthesis and Assessment Products*, (2007), and 3) *Guidance to Agency Leads Regarding the Preparation of CCSP Synthesis and Assessment*

Products (2006). Regarding the steps necessary in developing the assessment reports, CCSP (2004) describes the following procedures:

Planning the Process and Preparing a Prospectus

1. The lead agency(ies) solicit input from users and other stakeholders, plan preparation of the product, and summarize the proposed process in a draft prospectus. The draft prospectus will address the topics listed in the subsequent section of this document.

2. The CCSP Interagency Committee reviews and approves the draft prospectus for public comment.

3. Expert reviewers and stakeholders review the draft prospectus. The prospectus comment period will last at least 30 days. The draft prospectus comment period will be announced in a Federal Register Notice (FRN) and posted on the CCSP web site.

4. The lead agency(ies) revise the draft prospectus and finalize author recommendations, taking into consideration the comments received.

5. The CCSP Interagency Committee approves the revised prospectus and the lead agency(ies) notify the lead authors.

6. The CCSP Office posts the draft prospectus comments and the final prospectus on the CCSP web site.

Additional Stakeholder Interactions, if Needed

7. Lead authors may solicit additional input from users and other stakeholders to assist in the development of the product. The process for soliciting this additional input will be open and described in the prospectus. Approaches include workshops, user surveys, telephone and email conferences, and other mechanisms. The processes used will reflect the expected end use of the product. The CCSP Strategic Plan identifies three end uses for CCSP synthesis and assessment products: 1) informing the evolution of the research agenda; 2) supporting adaptive management and planning; and 3) supporting policy formulation. The products with end uses primarily oriented toward the second and third categories are expected to require significant additional input from users to develop a clear understanding of information needs, timing of decisions, consideration of how uncertainty affects decision making, and other issues. The results from additional stakeholder interactions will be publicly available in summary or more extensive forms through publication on the CCSP web site.

Drafting/Reviewing the Products

8. Lead authors prepare the first draft, including a technical section and a summary for interested non-specialists.

9. The lead agency(ies) organize and facilitate an expert peer review of the first draft according to process described in the prospectus. The expert peer review will precede the public comment period to ensure that the products are shaped by scientific considerations. The expert peer review process may range from that used in a scientific journal to a formal review panel convened by the lead agency or recognized external groups such as the National Research Council. Participants must be qualified scientific/technical experts, as demonstrated by their record of scholarly publication and other accomplishments. Employees of the lead agency(ies), lead authors, and other

contributors to the product may not serve as expert reviewers for that product. The prospectus will describe the process for selecting expert reviewers and the expected dates of the review. If the expert peer review is open to all qualified experts, notice will be disseminated on the CCSP web site and through relevant scientific publications, web sites, and other means. All comments submitted during the expert peer review will be publicly available without attribution to the reviewer unless reviewers agree in advance to posting with specific attribution.

10. Lead authors prepare the second draft of the product, taking into consideration the expert peer review comments. The scientific judgment of the lead authors will determine responses to the comments. The authors will acknowledge significant contributions made by expert reviewers, as applicable.

11. The lead agency(ies) post the second draft of the product for public comment for not less than 45 days. Any stakeholders (plus experts who participated in the expert peer review process) may participate in the public comment period for the second draft. This includes governmental and non-governmental entities. The prospectus will include the expected dates of the public comment period. Notice of the public comment period will be disseminated on the CCSP web site, in the Federal Register, and through other publications, web sites, and means as appropriate to the product, to encourage wide public participation in the review. All comments will be publicly available.

12. The lead authors will prepare a third draft of the product, taking into consideration the comments submitted during the public comment period. The scientific judgment of the lead authors will determine responses to the comments.

Approving, Producing, and Releasing the Products
13. Lead agency(ies) submit the third draft of the product and a compilation of comments received to the CCSP Interagency Committee.

14. If the CCSP Interagency Committee review determines that no further action is needed and that the product has been prepared in conformance with these guidelines and the Data Quality Act (including ensuring objectivity, utility, and integrity as defined in 67 FR 8452), they will submit the product to NSTC for approval. If the CCSP Interagency Committee determines that further revision is necessary, their comments will be sent to the lead agency(ies) for consideration and resolution by lead authors.

15. If needed, NRC can be asked to provide additional scientific analysis to bound scientific uncertainty associated with specific issues.

16. Once the CCSP Interagency Committee has determined that the synthesis and assessment report has been prepared in conformance with these guidelines and the Data Quality Act, the Committee will submit it to NSTC for final review and approval. Approval will require the concurrence of all members of the Committee on Environment and Natural Resources. Comments generated during the NSTC review will be addressed by the CCSP Interagency Committee.

17. Once NSTC approval has been obtained and the product is finalized, the lead agency(ies) will produce and release the completed product using a standard format for all CCSP synthesis and assessment products. The final product and the comments

received during the expert review and the public comment period will be posted, without attribution (unless specific reviewers agree to attribution), on the CCSP web site.

18. The product will be widely disseminated through the CCSP web site and other mechanisms.

The USGCRP/CCSP *Guidelines* (CCSP, 2004) lay out specific procedures regarding the roles and responsibilities of the lead agency or agencies, lead and contributing authors, interagency working groups, expert reviewers, stakeholders, NRC, and the National Science and Technology Council. These procedures were closely adhered to in developing the assessment reports and we note that no commenters submitted evidence to the contrary. The implementation of these guidelines ensured that the reports were being written using the best available science and objectively peer-reviewed. The *Guidelines* state:

> *Lead Agency(ies)/Department(s)*
> One or more designated CCSP agency(ies) or department(s) will take the lead in producing each product. The lead agency(ies) will be responsible for developing an open and transparent process for soliciting user input, author nomination and selection, expert peer review and public comment, and production/release of the products, as described in these guidelines. To ensure that the products incorporate as much expertise as possible, the lead agency(ies) will be open to the participation of other individuals or entities with relevant expertise and information. The entities can include other government units (Federal or non-Federal), Interagency Working Groups of the CCSP or other Federal programs, international organizations and government units, non-governmental organizations (NGOs), and other groups.
>
> *Lead and Contributing Authors*
> Lead and contributing authors of the synthesis and assessment products are scientists or individuals with recognized technical expertise appropriate to a product. Lead and contributing authors may be citizens of any country and be drawn from within or outside the Federal government (e.g., universities or other public or private sector organizations). These individuals shall be acknowledged experts, known through their publication record and relevant accomplishments and contributions to their field. Lead authors are responsible for the content of the synthesis and assessment products that are submitted to the CCSP Interagency Committee for review.
>
> *Interagency Working Groups*
> The CCSP Interagency Committee coordinates implementation of its activities in support of the Strategic Plan through Interagency Working Groups (IWGs) of program specialists of its participating departments and agencies, as described in Chapter 16, "Program Management and Review," of the CCSP Strategic Plan. IWGs will contribute significantly to the preparation of the synthesis and assessment products because of their expertise in areas related to the products. IWGs may serve as a means for the lead agency(ies) to coordinate preparation of the products with supporting agencies. They may contribute to planning/preparing the prospectuses, scoping, drafting, reviewing, publishing, or disseminating the final product.
>
> *Expert Reviewers*
> Expert reviewers are scientists or individuals with other special expertise appropriate to a product. The expert reviewers will be selected by the lead agency(ies)/departments. As is the case for lead and contributing authors, reviewers may be citizens of any country and be drawn from within or outside the Federal government (e.g., universities or other public

> or private sector organizations). These individuals shall be known through their publications and other forms of recognition of their expertise. Expert reviewers will focus on the scientific/technical content of the draft. Employees of the lead agency(ies), lead authors, and other contributors to the product may not serve as expert reviewers for that product. The expert reviewers will be designated through a process described in the prospectus.
>
> *Stakeholders*
> Stakeholders are defined as they are in Chapter 11 of the CCSP Strategic Plan—that is, "Stakeholders are individuals or groups whose interests (financial, cultural, value-based, or other) are affected by climate variability, climate change, or options for adapting to or mitigating these phenomena." Stakeholders participate during the scoping process by providing information that helps define the audience and potential uses of a product. In addition, stakeholders provide comments on the prospectus, and on the product during the public comment period. These comments are expected to focus on how well the product serves its intended purpose or use.
>
> *National Research Council*
> The National Academy of Sciences / National Research Council (NRC) will provide advice on an as-needed basis to the lead agency(ies). In the event that issues are identified that require further clarification, the NRC may be asked to provide additional scientific analyses to help bound the uncertainty associated with these issues.
>
> *National Science and Technology Council*
> The National Science and Technology Council (NSTC) will be responsible for final review and approval of the synthesis and assessment products. Products not cleared by NSTC cannot be released as disseminations of the Federal government. Consistent with NSTC procedures, approvals will require written concurrence from all members of the NSTC's Committee on Environment and Natural Resources (CENR). All comments generated through the NSTC review will be addressed by the CCSP Interagency Committee. The CENR membership includes senior officials representing the Executive Office of the President and the 15 federal agencies with significant responsibilities for environment and natural resources programs.

The USGCRP/CCSP *Guidelines* (CCSP, 2004) also lay out specific procedures regarding the types of scientific materials to be used in the development of the assessment reports. This ensures that the reports are credible, robust, and representative of the best available science. After reviewing the final USGCRP and CCSP products, we find that these guidelines were consistently implemented. The *Guidelines* state:

> Authors will use the published, peer-reviewed scientific literature in drafting the products. In the rare case that any materials used in preparing a product are not already published in the peer-reviewed literature, the lead agency(ies) must get approval from the CCSP Interagency Committee and these materials must be made available by the lead agency(ies) and/or CCSP Office. The use of any such non-peer-reviewed materials may be questioned by reviewers during the expert review or public comment period. Authors should seek to publish any materials used in preparing drafts of the products.

To ensure transparency in the assessment report development process, USGCRP/CCSP provided the public with access to a series of documents, including invitations for public comment periods on the prospectus' and preliminary drafts, compilations of comments received from the public and experts, and revised versions of the reports. For each assessment report, the following products were posted on the

appropriate synthesis and assessment product (SAP) Web site, although we note that additional SAP-specific products were posted for many of the reports:

> Invitation for public comment on draft prospectus
> Draft prospectus
> Public comments on draft prospectus
> Final prospectus
> Peer review plan (if not part of the prospectus)
> Expert review comments on first draft report and authors' responses to them
> Invitation for public comment on second draft report
> Second draft report
> Public comments on second draft report and authors' responses to them
> Third draft report
> Final report

Finally, to ensure that each assessment report complied with the Information Quality Act (IQA) and was fully responsive to all comments received from the public and expert review, the USGCRP/CCSP *Guidelines* (CCSP, 2004) state that:

> When the lead agency transmits the product for final clearance, they should include a memorandum briefly indicating that *"the product was prepared in compliance with CCSP's Guidelines for Producing Synthesis and Assessment Products, the Information Quality Act (Section 515) and [LEAD AGENCY'S] corresponding IQA guidelines; and the Federal Advisory Committee Act [when applicable]."* This transmittal should include the authors' responses to the peer reviewer comments, as required by OMB's Information Quality Bulletin for Peer Review, as well as descriptions of how the authors addressed the public comments and lead agency's review comments.

Comment (1-26):
A commenter (4036.5) states that EPA's use of CCSP 4.6 (Gamble, 2008) and the IPCC (2007) Working Group II chapter on human health impacts represent the consensus opinion of the world's leading scientists studying health impacts of climate change.

Response (1-26):
CCSP 4.6 and the IPCC chapter on human health impacts are robust sources of information to serve as primary sources for the discussion of health impacts. See Volume 5 of the Response to Comments for responses to specific comments on human health and air quality.

Comment (1-27):
Two commenters (3446.2 and 3136.1) note numerous errors and contentious statements in the public draft of USGCRP's assessment report *Global Climate Change Impacts in the United States* and cautioned that this document was not based on best available science.

Response (1-27):
EPA did not cite the draft USGCRP report in the version of the TSD released in April 2009 with the Proposed Findings. However, we have revised the TSD to incorporate the conclusions of the final USGCRP report, which was released in June 2009 (Karl et al., 2009). Regarding the quality and accuracy of the public review draft, we note that USGCRP substantially revised the report following the two

separate rounds of public comment and expert review. Commenters can review how USGCRP responded to the comments received at (http://www.climatescience.gov/Library/sap/usp/default.php).

Please see other relevant Response to Comment volumes for our response to specific comments on the USGCRP that relate to the TSD's discussion of particular issues. See our response to other comments summarized in this section of this volume for a description of our rationale as to why the USGCRP report represents the best available scientific information and, in its final form, meets the TSD's established reference criteria.

Comment (1-28):
As evidence why the EPA should not rely on CCSP synthesis reports, a commenter (3136.1) submitted to EPA their comments on the USGCRP's *Global Climate Change Impacts on the United States,* originally submitted during the public comment period for that report. While nearly all of the comments raised by commenter 3136.1 address specific issues regarding the climate science and impacts information within the USGCRP report, one overarching issue raised in the comments was that the USGCRP authors made little effort to consider or include any dissenting opinion to their declarative statements.

Response (1-28):
EPA has reviewed the comments submitted, and our responses are provided in the relevant Response to Comment volumes related to the TSD's discussion of particular climate science and impacts issues. We also refer commenters to previous responses to comments in this section regarding the USGCRP/CCSP report development process. We also note that Box 1.1 of the TSD provides a description of the peer-review, publication, and approval processes employed by CCSP and USGCRP in developing their assessment reports.

The overarching comment that USGCRP made little effort to consider or include dissenting opinions is inconsistent with the process used by USGCRP in developing the report. We note that the USGCRP report and the previously developed CCSP reports have assessed numerous individual, peer-reviewed studies in order to draw general conclusions about the state of the science. This process involves weighing the quality of different individual studies (including dissenting opinions), reconciling studies with divergent conclusions, and acknowledging divergent conclusions (or a dearth of findings for a given area) to highlight key scientific uncertainties and gaps in knowledge. Further, CCSP and USGCRP provided multiple opportunities for input through several public comment periods, which were held for each SAP and the synthesis report. These comment periods allowed the public to submit dissenting opinions and studies that were considered by CCSP prior to releasing the final reports. Responses to the comments received during the two rounds of public review and two rounds of expert peer-review on the draft synthesis report can be viewed at http://www.climatescience.gov/Library/sap/usp/default.php. Finally, we note that the USGCRP/CCSP memorandum on *Clarification of Review and Clearance Process for CCSP Synthesis and Assessment Products* states that final clearance procedures employed by CCSP ensure that the officials with legal responsibility for the assessment reports have reviewed and approved them, with particular consideration that "the expert review and public comments were adequately addressed by the authors."

Comment (1-29):
A commenter (2684.1) argues that the CCSP reports cited by EPA are not used as references in peer-review scientific papers, and that without technical merit, these papers are of little scientific value.

Response (1-29):

We disagree with the commenter that the CCSP reports are not being used as references in reports and papers. We analyzed the citation rate of CCSP reports in recent published, peer-reviewed studies and found that these assessments are being referenced frequently, especially since these reports were only recently released (most in 2008 and 2009). For example, a CCSP report on temperature trends in the lower atmosphere (CCSP, 2006) has been cited in over 50 papers published in peer-reviewed science journals. For the reasons provided in the Findings, Section III.A., and our response to comments in the section, we find that the CCSP reports represent scientifically robust and credible sources of information on climate science and impacts.

Comment (1-30):
A commenter (3411.1) argues that there are additional studies on the issue of air quality impacts that the Agency does not address in the proposed endangerment finding or the TSD. The commenter requests an on-the-record proceeding at which all the available government-funded studies can be assessed.

Response (1-30):
See previous responses in this section for our response regarding the approach taken to review and reflect additional studies and new literature in the endangerment analysis. See Response to Comment Volume 5 for our response to specific comments on the issue of air quality impacts, which includes responses to additional studies submitted through the public comment process. See Section 1.C.1(e) of the Findings for our response to comments on the subject of an "on-the-record proceeding" under the Administrative Procedures Act.

1.2 Level of Scientific Certainty

Comment (1-31):
A commenter (2692) indicates that EPA's discussion of the health impacts of climate change contains ambiguous terms such as "difficult to ascertain," "expected," "could," "potential," "likely," "can," "very likely," "likely to," "may," and "projected." Yet the EPA draws a "compelling and indeed, overwhelming" conclusion from such ambiguity. The commenter argues that how EPA arrives at this conclusion is puzzling.

Response (1-31):
In response to this comment, EPA has reviewed both the use of these terms in the TSD and Findings, as well as the explanation of our approach in the TSD. We agree with the commenter that clear and careful communication of uncertainty is important, and this is, in fact, a strength of the TSD. Box 1.2 of the TSD summarizes the approach and lexicon developed by the IPCC, USGCRP, and CCSP for the consistent communication of uncertainty and likelihood. As the TSD makes clear, the IPCC, USGCRP, and CCSP have established guidelines for the use of these types of terms precisely to minimize the ambiguity and misinterpretation that can occur when their meaning is not defined. In summarizing the existing and fully vetted literature, we adopted this existing approach.

Many of the terms identified by the commenter are defined in Box 1.2, to aid readers in better understanding the implications of various statements throughout the TSD. For example, "likelihood" refers to a probabilistic assessment of some well-defined outcome having occurred or occurring in the future, and may be based on quantitative analysis or an elicitation of expert views. Terms used to describe likelihood of certain outcomes include "virtually certain," "very likely," "likely," "about as likely as not," "unlikely," "very unlikely," and "exceptionally unlikely"; as summarized in the Box 1.2, each term has an associated probability of occurrence. The term "projected" is used to explain an outcome in the future

typically based on modeling analysis and are often accompanied by a term to communicate the outcome's probability. Because the TSD summarizes the results of the major climate assessment reports, we concluded it was neither necessary nor appropriate for EPA to develop a new vernacular to convey likelihood and probability information. There are some phrases used in the TSD, such as "difficult to ascertain," that indicate that available information is insufficient for experts to make an assessment or assign a probability.

In response to this comment, we also revised Box 1.2 of the TSD to enumerate potential sources of uncertainty and add discussion about the importance of characterizing uncertainty. We also made revisions to more clearly describe how confidence levels were developed in IPCC (2007).

See Section IV.B. of the Findings for a description of how the Administrator weighed the information contained in the TSD and broader record in making the endangerment determination, and her view of the weight of the evidence.

Comment (1-32):
Some commenters (e.g., 1927) state that policy and regulation should not be based on likelihood and that IPCC statements, for example, cannot be proven with certainty. A commenter (3397) argues that EPA did not provide sufficient guidance on the likelihood of occurrence of impacts.

Response (1-32):
See our response to the previous comment regarding how EPA communicated information on uncertainty and likelihood in the TSD. See II.A.2.a. of the Findings for our response on the question of whether policy and regulation can be based on likelihood, and Section IV.B. of the Findings for our response to comments regarding how the Administrator weighed the information contained in the TSD and the broader record.

To the extent possible, EPA indicates the likelihood of occurrence in its discussion of impacts. Box 1.2 in EPA's TSD describes the communication of confidence and uncertainty for IPCC and USGCRP (or CCSP) assessments, which are its primary underlying references. When EPA cites these references, it retains their confidence and uncertainty language.

Comment (1-33):
A large number of commenters (e.g., 0463, 0727, 1927, 2253, 2750, 2898.1, 2923, 3080, 3347.1, 3384, 3427.1, 3435.1, 3498.1, 3507.1, 3559.1, 3577.1, 3559.1, 3577.1, 3702.2, 3830.1, 4738, 4173ANPRref1, 8978.1, A13, 10855, 10160, 11459) posit that the evidence for human-induced warming is weak or the consequences of global warming, even if human-induced, are too uncertain to make an endangerment finding. Many commenters note the evidence of harm is equivocal and/or doubt that possible current/future negative effects from warming outweigh benefits. Some commenters (4002, 3435.1) suggest that in light of the uncertainties enumerated by EPA and potential positive climate change effects, the endangerment finding appears to be more of a political than a scientific determination.

Response (1-33):
The Administrator carefully evaluated the scientific evidence summarized in the TSD, which reflects the major conclusions of the assessment literature on issues pertinent to this finding. The public comments submitted on this action, including other scientific literature, were also reviewed and considered. On the basis of her review, the Administrator finds that the scientific information in totality provides compelling evidence of human-induced climate change. Section IV.B. of the Findings describes the Administrator's

determination regarding the consequences of climate change and why they justify a finding of endangerment. For the reasons explained there, the Administrator rejects the view that the consequences are too uncertain to justify an endangerment finding.

Many of the commenters who maintain there is too much uncertainty to support an endangerment finding raise specific scientific and technical concerns; our responses to these specific comments are provided in the other volumes of the Response to Comments document.

At least one commenter incorrectly claims the decision is more a political than a scientific determination. Section II of the Findings ("the Legal Framework for this Action") explains how Section 202(a) requires the Administrator to exercise her judgment and apply the evidence to the statutory endangerment criteria. As stated there, "[b]Because scientific knowledge is constantly evolving, the Administrator may be called upon to make decisions while recognizing the uncertainties and limitations of the data or information available, as risks to public health or welfare may involve the frontiers of scientific or medical knowledge. At the same time, the Administrator must exercise reasoned decision making, and avoid speculative inquiries." That is what the Administrator has done, and the result is neither a political nor a scientific decision, but an exercise of judgment that is informed by and strongly grounded in the science and the law.

Comment (1-34):
A number of commenters (0152, 0718, 0726, 0730, 2895, 3502.1ANPRref1, 4036.5, 5844, 6708, and 9418) state EPA can and should act in the face of uncertainty, as the Agency has done in the past, to prevent threat to human health and the environment consonant with the bedrock foundation of the CAA, a law that is anchored in protective action. Some of these commenters also indicate it is wise for EPA to act in light of the number of scientists whose findings support EPA's actions.

Response (1-34):
As discussed in Section II of the Findings, the Administrator is required to protect public health and welfare, but she is not asked to wait until harm has occurred. EPA must be ready to take regulatory action to prevent harm before it occurs. Section 202(a)(1) requires the Administrator to "anticipate" "danger" to public health or welfare. The Administrator is thus to consider both current and future risks. See above comment response regarding the Administrator consideration of uncertainty.

Comment (1-35):
A commenter (2895) recommends that EPA make policy based on probability rather than uncertainty. The commenter cautions that making policy based on uncertainty would require EPA to consider all future possibilities irrespective of their likelihood. It suggests EPA rely on the most likely scenarios in its decision-making.

Response (1-35):
The Administrator made her findings based on the totality of scientific evidence, some of which was assessed as being virtually certain or had been assigned high or very high probabilities in the assessment literature, while other evidence was less certain. The Administrator considered all of this evidence, and did not restrict herself to only the evidence of highest likelihood. She weighted and evaluated those scenarios, as well as scenarios of lesser probability, to evaluate the full range of risks and potential harms that climate change could lead to in the United States. See Section IV.B. of the Findings for her rationale in finding endangerment of both public health and welfare.

Comment (1-36):
Several comments (2057, 3291.1, 3906) argue IPCC's lexicon for communicating uncertainty is flawed. One comment argues that the probability assessments of IPCC reflect the judgment of the authors rather than empirical data, and that the IPCC probability assessments express greater certainty than the actual method supports. Specifically, it notes when presenting statistical information, IPCC uses a 90 percent confidence interval, not the 95 percent confidence interval that is standard scientific practice, making the results look more robust than they actually are.

Response (1-36):
IPCC's application of uncertainty lexicon is primarily based on the results of probabilistic assessments and some are based on an elicitation of expert views rather than quantitative analysis. However, given the level of expertise of IPCC-nominated lead authors as well as the multi-stage review process, we find that the expert elicitation conducted by IPCC is legitimate. More information regarding the approach to addressing uncertainties in IPCC (2007) is available in the document *Guidance Notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties*, which is located in Appendix A of this volume

The assertion that IPCC strayed from scientific convention in its use of 90% confidence intervals is baseless. In statistical analysis, 5^{th} and 95^{th} percentiles are commonly used because they refer to a result two standard deviations from the mean in a normal distribution – in other words, they help show how much variation there is from the average or mean. The probabilistic assessments performed by IPCC are not statistical analyses but rather reflect expert elicitation and/or the results of quantitative analysis. These are two different processes. There is no rationale for the IPCC to adopt the statistical convention for describing a normal distribution to characterize uncertainty.

Comment (1-37):
A number of commenters (e.g., 0659, 1312, and 10855) note that scientists were offering warnings about global cooling in the 1970s (some cite examples), and therefore question the credibility of climate change science and the plausibility of projections.

Response (1-37):
Climate change statements and predictions made in the 1970s were not based on the current state of climate change science knowledge. Since the 1970s, marked improvements have been made in scientific understanding of climate change due to important theoretical discoveries, new and improved observing systems, and vastly superior computational and modeling resources. Furthermore, a recent study (Peterson et al., 2008) surveyed scientific papers published between 1965 and 1979 that projected future climate trends, and found that only 12% inclined toward future cooling, while most papers predicted future warming. The study concluded: "There was no scientific consensus in the 1970s that the Earth was headed into an imminent ice age. Indeed, the possibility of anthropogenic warming dominated the peer-reviewed literature even then."

Comment (1-38):
Many commenters (e.g., 0223, 0261, 0524, 0718, 0726, 1318.1, 3361.1, 3454.1, 3455.1, 3606.1, 3893, 3940, 4136, 4171, 4247, 4841, 6055, 6227, 6465, 6525, 6599, 6622, 6936, 6937, 9298, 9520, 9642, 10003, 10033, 11198, 11249, 11305) argue that the state of the science (i.e., breadth and depth) is strong enough to defend the Proposed Findings and that there exists "incontrovertible evidence…that carbon dioxide and other global warming pollution endangers public health and welfare."

Response (1-38):
We agree with the commenters that the state of the science is strong enough to support the finding.

Comment (1-39):
Commenters (e.g. 3080, 10160) argue EPA should consider the option of waiting some period of time to make an endangerment determination because the scientific uncertainty is too great to make a determination at present.

Response (1-39):
The Administrator has determined the scientific information available now is sufficiently robust for making an endangerment finding. For more information on the Administrator's rationale for making her finding, please refer to Section IV.B. of the Findings.

Comment (1-40):
Several commenters (3283.1, 4173ANPRref1) specifically reference the 2001 NRC report *Climate Change Science: An Analysis of Some Key Questions* (NRC, 2001a) to assert that the science is too uncertain for the Administrator to make a reasoned judgment on endangerment. They note that report stated, for example, that a causal linkage between the buildup of greenhouse gases in the atmosphere and the observed climate change during the 20th century cannot be unequivocally established (owing to the still uncertain natural variability inherent in the climate record and the uncertainties in the time histories of the various forcing agents and particularly aerosols) and that the health consequences of climate change are poorly understood. One commenter argues that since the 2001 NRC report, areas of concern noted by NRC like the importance of aerosols have become less well understood. The commenter concludes that EPA has not demonstrated the scientific information supporting the endangerment finding is adequate.

Response (1-40):
We disagree that the scientific information supporting the endangerment finding is inadequate. Please refer to Section III.A. of the Findings for a discussion of the science on which the decisions are based and Section IV.B. for a discussion of how the science was weighed and evaluated, including uncertainty.

The 2001 NRC report is one of the assessment reports we relied upon in the TSD. The findings of this report still represent the state of the science. However, this report is now over eight years old and many of its findings have been updated in more recent assessment literature. For example, though NRC (2001a) refers to "still uncertain natural variability," the IPCC (Hegerl et al., 2007) states that it is very unlikely (less than 10% probability) that the global pattern of warming observed during the past half century is due to only known natural external causes (solar activity and volcanoes) and that global-mean unforced variations on multidecadal timescales are likely (66–90% probability) to be smaller than the 20th century global-mean increase in surface temperature. Regarding the "uncertainties in the time histories of the various forcing agents and particularly aerosols" indicated by NRC (2001a), we note that IPCC (2007d) states with very high confidence (at least 90% certainty) that the global average net effect of human activities since 1750 has been one of warming, with a radiative forcing of +1.6 (+0.6 to +2.4) W/m^2. Though uncertainties in aerosol contributions to radiative forcing remain, the commenter's assertion that aerosols have become less understood since 2001 is incorrect. In fact, IPCC (Forster et al., 2007) states, "Atmospheric models have improved and many now represent all aerosol components of significance. Improved *in situ*, satellite and surface-based measurements have enabled verification of global aerosol models." Although NRC (2001a) stated that health effects of climate change are "poorly

understood," we note that many health effects of climate change are well-documented in the most recent assessment literature (Confalonieri et al., 2007; CCSP, 2008b; Karl et al., 2009), as described in Sections 7 and 8 of the TSD.

Finally, although NRC (2001a) contains the above cautionary statements which have been updated in more recent assessment reports, we note that the report begins with the following statement which continues to be broadly consistent with the current assessment literature: "Greenhouse gases are accumulating in Earth's atmosphere as a result of human activities, causing surface air temperatures and subsurface ocean temperatures to rise. Temperatures are, in fact, rising."

Section II of the Findings discusses how EPA considers uncertainty in making an endangerment decision. The apparent criteria suggested by the commenter are not appropriate for the reasons discussed in Section II.

Comment (1-41):
At least one commenter (3347.1) notes that many of EPA's predictions depend on a causal chain of multiple events occurring. The comment explains that the likelihood of a series of uncertain events is the product of their probabilities, which approaches zero as the number of events in the series increases. It concludes that EPA cannot base a reasoned decision, even one that does not require certainty or actual proof, on data, studies, and assumptions that are of little or unknown reliability.

Response (1-41):
The commenter is referring to the concept of propagation of uncertainty, which does not change the legitimacy of scientific projections described in the TSD or considered in the Administrator's endangerment finding. The document *Guidance Notes for Lead Authors of the IPCC Fourth Assessment Report on Addressing Uncertainties* (see Appendix A of this Volume) directs IPCC (2007) authors to the Third Assessment uncertainty guidance document (Moss and Schneider, 2000) and an IPCC workshop report (Manning et al., 2004) which discuss this issue. IPCC authors are advised to take into account propagation of uncertainty and other potential sources of uncertainty in their statements and findings. In other words, the fact that uncertainty accumulates through a chain of causation is reflected and communicated in the results presented in the assessment literature (e.g., by describing ranges, levels of confidence/certainty).

The IPCC workshop report (Manning et al., 2004) states that "There is a recognized cascade of uncertainty when proceeding through projected climate change, projected effects of that change, and projected adaptation or mitigation responses. See Figure 3-1. Dealing with this uncertainty cascade is complex and it should not be assumed that uncertainties add in the sense of being statistically uncorrelated." Figure 3-1 shows five uncertainties between emissions and impacts: uncertainty in emissions scenarios, in carbon cycle response, in climate sensitivity, in regional scenarios, and in range of possible impacts. This figure demonstrates two key issues. One is that there are a limited number of uncertainties in the chain, in contrast to the implication of the commenter that the number of events in this series is large. Most of the uncertainties in climate change do not depend on each other: for example, uncertainty in the dependence of Atlantic hurricane frequency on sea surface temperature changes is mostly independent from the uncertainty in the relation between extreme heat events in the Midwest and global average temperature increase. Second, the uncertainty is not a "does it exist/does it not exist" causal chain of events as described by the commenter, but rather a set of uncertainties that are each distributions of outcomes around a central value, with dependence on the previous uncertainty in the chain. This means that the central estimate (or median) outcome has little dependence on the number of uncertainties in the chain, and also that both tails of these distributions grow as the number of uncertainties increase. The final "range of impacts" shows that inclusion of uncertainty should lead to

higher estimates as often as lower estimates. Figure 10.26 of Meehl et al. (2007) demonstrates these attributes of combining uncertainties: it shows global mean temperature projections from six different emission scenarios, including uncertainty in carbon cycle response and in the structural parameters of the models. There are larger uncertainties when including carbon cycle uncertainties on top of the model uncertainties, but these uncertainties lead to higher temperatures than the original distribution as well as lower temperatures.

The CCSP (2009) report *Best Practice Approaches for Characterizing, Communicating, and Incorporating Scientific Uncertainty in Decisionmaking* suggests that propagation of uncertainty can be constrained by running an analysis over and over again on a fast computer, using different input values, from which it is possible to compile the results into probability distributions. This approach is termed "stochastic simulation" or "Monte Carlo." A number of the studies assessed by the IPCC and CCSP reports employed such an approach to quantitatively combine the cascade of uncertainties into output probability distributions.

Therefore, we conclude that the assessment literature has appropriately addressed the well-recognized "cascade of uncertainty," and that the underlying science is sufficiently well characterized for use in making reasoned decisions.

Comment (1-42):
At least one commenter (3722) argues the Administrator's conclusions in the Proposed Findings overstate scientific understanding of climate change. The comment specifically refers to the following two statements:

> It is clear that current and projected levels of greenhouse gases and resultant climate change are already and adversely affecting, and will continue to adversely affect, public welfare within the meaning of the Act.
>
> The evidence points ineluctably to the conclusion that climate change is upon us as a result of greenhouse gas emissions, that climatic changes are already occurring that harm our health and welfare, and that the effects will only worsen over time in the absence of regulatory action.

The commenter concludes that these unequivocal warnings mischaracterize the state of climate science and obscure the fundamental uncertainties.

Response (1-42):
The specific language highlighted by the commenter has been revised in the Findings. The key science from the assessment literature underlying these statements remains strong and accurate.

Comment (1-43):
Many commenters (e.g. 0525, 1312, 2895, 2923, 3450.1, 3507.1, 3553.1, 3569.1, 3722, 3915, 4092, 4395, 7019, 11225, and 11290) question the notion of scientific consensus around the conclusion of human-induced global warming and/or mention the existence of large numbers of dissenting scientists who have reached alternative findings to those of IPCC and CCSP/USGCRP, indicating profound scientific uncertainty. As evidence of these dissenting viewpoints, commenters refer to:

> The 35+ scientists who participated in the NIPCC.

The U.S. Senate Minority Report Update Report of March 17, 2009 (see http://epw.senate.gov/public/index.cfm?FuseAction=Minority.Blogs&ContentRecord_id=2674e64f-802a-23ad-490b-bd9faf4dcdb7), which states that more than 700 prominent international scientists, including many current and former members of the IPCC, disagree with the man-made global warming claim.

A group of more than 31,000 scientists (including 9,021 Ph.D.s) who signed a petition from the Oregon Institute of Science and Medicine (http://www.oism.org/pproject/) urging the U.S. government to reject the global warming agreement that was written in Kyoto, Japan, in December, 1997, and any other similar proposals (petition began in 1998).

An open letter to the Secretary-General of the United Nations in 2001, signed by over 100 scientists, statisticians, and economists, urging the United Nations to direct its efforts toward dealing with climate change impacts and adaptation, rather than climate change prevention.

The Manhattan Declaration (ISCC, 2008: http://www.climatescienceinternational.org/index.php?option=com_content&task=view&id=37&Itemid=1), dated March 4, 2008, in which scientists, researchers, economists, and policymakers asserted the scientific consensus on climate change is overstated. The signatories recommended that world leaders reject the IPCC views and declare that "human-caused climate change is not a global crisis." The Declaration was signed by over 600 individuals.

At least one commenter (3283.1) indicates that EPA cites consensus without specifically describing the meaning and context of that consensus.

Response (1-43):

A response to the NIPCC report cited by commenters as evidence of dissenting scientific viewpoints can be found at comment response (1-12) in Section 1 of this volume. In addition, please refer to Section III.B. of the Findings for a discussion of the science on which the decisions are based.

We first note that the strength of the science is not determined by petitions or lists of names; rather it is determined by the detailed examination of the fully body of literature, as has been done in the assessment reports, and as has been done in response to comments throughout the volumes of this Response to Comments document. Such a review demonstrates that the scientific basis for the TSD and the Administrator's determination is sound. We respond to the specific petitions below:

Regarding the U.S. Senate Minority Report listing dissenting scientists, we note that the Center for Inquiry[1] recently released a study (Center for Inquiry, 2009: http://www.centerforinquiry.net/opp/news/senate_minority_report_on_global_warming_not_credible/) which found that 80 percent of "dissenting scientists" in said report had not published peer-reviewed climate research. The study also noted that of the report's purported list of 700 scientists:

Slightly fewer than 10 percent could be identified as climate scientists.

Approximately 15 percent had published in the recognizable refereed literature on subjects related to climate science.

Approximately 4 percent appeared to favor the current IPCC-2007 consensus and should not have been on the list.

The Center for Inquiry draws the following conclusions based on its analysis:

[1] The Center for Inquiry (http://www.centerforinquiry.net/opp/about) describes itself as a nonpartisan, nonprofit 501(c)(3) organization that encourages evidence-based inquiry into science, pseudoscience, medicine and health, religion, ethics, secularism, and society.

1) We think it is highly unlikely that a growing fraction of top climate scientists are becoming increasingly skeptical of human causation of global warming.

2) We think that the title "Senate Minority Report" is technically appropriate, but grossly understated. That report's list does contain the names of some outstanding scientists, including at least one distinguished meteorologist. However, when weighted against the much larger number of equally outstanding climate scientists, there is no doubt where the great majority of experts in this field stand.

Though the declarations, petitions, and letters referred to by commenters demonstrate the existence of dissenting viewpoints, they do not represent the viewpoints of the overwhelming majority of the active climate science research community nor provide legitimate scientific evidence to substantiate the alternative points of view presented. For example, though the Oregon Petition is accompanied by a study (Robinson et al., 2007) refuting many conclusions of the climate science assessment literature, it is published in a medical journal unrelated to climate science.

We further note a recent polling study (Doran and Zimmerman, 2009) in which researchers found 75 out of 77 climatologists who "listed climate science as their area of expertise and who also have published more than 50% of their recent peer-reviewed papers on the subject of climate change" believe that human activity is a significant factor in changing mean global temperatures. The study concludes: "It seems that the debate on the authenticity of global warming and the role played by human activity is largely nonexistent among those who understand the nuances and scientific basis of long-term climate processes."

It is also relevant to point out that many major national and international scientific societies and academies have endorsed or expressed support for the findings and conclusions of the assessment literature cited by EPA in official statements. The following are some examples:

Since 2005, the Academies of Science for the G8+5 countries have issued joint statements on the threat of climate change.

- The 2005 statement reported: "…there is now strong evidence that significant global warming is occurring. The evidence comes from direct measurements of rising surface air temperatures and subsurface ocean temperatures and from phenomena such as increases in average global sea levels, retreating glaciers, and changes to many physical and biological systems. It is likely that most of the warming in recent decades can be attributed to human activities (IPCC 2001). This warming has already led to changes in the Earth's climate." http://www.nationalacademies.org/onpi/06072005.pdf
- The 2007 statement finds: "Recent research strongly reinforces our previous conclusions. It is unequivocal that the climate is changing, and it is very likely that this is predominantly caused by the increasing human interference with the atmosphere. These changes will transform the environmental conditions on Earth unless counter-measures are taken." http://www.nationalacademies.org/includes/G8Statement_Energy_07_May.pdf
- The 2008 statement notes: "In 2007 the Intergovernmental Panel on Climate Change (IPCC) reaffirmed that climate change is happening and that anthropogenic warming is influencing many physical and biological systems" http://www.nationalacademies.org/includes/climatechangestatement.pdf
- The 2009 Statement reports: "The IPCC 2007 Fourth Assessment of climate change science concluded that large reductions in the emissions of greenhouse gases, principally carbon dioxide (CO_2), are needed soon to slow the increase of atmospheric

concentrations, and avoid reaching unacceptable levels. However, climate change is happening even faster than previously estimated; global CO_2 emissions since 2000 have been higher than even the highest predictions, Arctic sea ice has been melting at rates much faster than predicted, and the rise in the sea level has become more rapid. Feedbacks in the climate system might lead to much more rapid climate changes." http://www.nationalacademies.org/includes/G8+5energy-climate09.pdf

The American Meteorological Society in 2007 stated: "…there is adequate evidence from observations and interpretations of climate simulations to conclude that the atmosphere, ocean, and land surface are warming; that humans have significantly contributed to this change; and that further climate change will continue to have important impacts on human societies, on economies, on ecosystems, and on wildlife through the 21st century and beyond." We further note the AMS mentions: "This statement is consistent with the vast weight of current scientific understanding as expressed in assessments and reports from the Intergovernmental Panel on Climate Change, the U. S. National Academy of Sciences, and the U. S. Climate Change Science Program." http://www.ametsoc.org/policy/2007climatechange.html

The American Chemical Society writes: "There is very little room for doubt that observed climate trends are due to human activities. The threats are serious and action is urgently needed to mitigate the risks of climate change." We note that ACS cites IPCC (2007) as a core reference for its statement which is valid for the period 2007–2010.
http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_SUPERARTICLE&node_id=1907&use_sec=false&sec_url_var=region1&__uuid=34a7ad19-6b0b-4720-a706-e25e4e609d6d

The American Geophysical Union in 2007 writes: "The Earth's climate is now clearly out of balance and is warming…With climate change, as with ozone depletion, the human footprint on Earth is apparent. The cause of disruptive climate change, unlike ozone depletion, is tied to energy use and runs through modern society. Solutions will necessarily involve all aspects of society." http://www.agu.org/outreach/science_policy/positions/climate_change2008.shtml.

We further note that Alan Leshner, Chief Executive Officer of AAAS, submitted a comment (in response to EPA's ANPR, 1009.1), in which he states:

> …AAAS seeks to offer requested comments on "the best available science for purposes of the endangerment discussion."
>
> The AAAS Board of Directors approved a statement on climate change in December 2006 based largely on the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and the 2005 Joint National Academies' statement. The statement, in part, recognizes:
>
> "The scientific evidence is clear: global climate change caused by human activities is occurring now, and it is a growing threat to society. Accumulating data from across the globe reveal a wide array of effects: rapidly melting glaciers, destabilization of major ice sheets, increases in extreme weather, rising sea level, shifts in species ranges, and more."
>
> Since the statement was released, the IPCC Fourth Assessment Report has been released, finding greater observed and projected climate change impacts, many of which are cited in the ANPR. These are also consistent with the AAAS statement:
>
> "As expected, intensification of droughts, heat waves, floods, wildfires, and severe storms is occurring, with a mounting toll on vulnerable ecosystems and societies. These

> events are early warning signs of even more devastating damage to come, some of which will be irreversible."
>
> These and other impacts identified in the ANPR reflect the current state of the science, as articulated in the consensus documents of the IPCC. This science shows clear impacts to society that are occurring now and will continue to grow.
>
> We hope that the Environmental Protection Agency continues to rely upon this sound scientific basis as it moves forward on decisions related to climate policy.

In addition, on October 21, 2009, 18 U.S. scientific societies and/or research institutions (including all of those mentioned above) reaffirmed the consensus on climate change in a letter[2] to U.S. senators, stating:

> Observations throughout the world make it clear that climate change is occurring, and rigorous scientific research demonstrates that the greenhouse gases emitted by human activities are the primary driver. These conclusions are based on multiple independent lines of evidence, and contrary assertions are inconsistent with an objective assessment of the vast body of peer-reviewed science. Moreover, there is strong evidence that ongoing climate change will have broad impacts on society, including the global economy and on the environment. For the United States, climate change impacts include sea level rise for coastal states, greater threats of extreme weather events, and increased risk of regional water scarcity, urban heat waves, western wildfires, and the disturbance of biological systems throughout the country. The severity of climate change impacts is expected to increase substantially in the coming decades.
>
> If we are to avoid the most severe impacts of climate change, emissions of greenhouse gases must be dramatically reduced.

These societies and organizations noted that their conclusions "reflect the scientific consensus represented by, for example, the Intergovernmental Panel on Climate Change and U.S. Global Change Research Program." They also noted that many scientific societies have endorsed these findings in their own statements, including the American Association for the Advancement of Science, American Chemical Society, American Geophysical Union, and American Meteorological Society (as documented above), as well as the American Statistical Association and Crop Science Society of America.

Regarding the claim that EPA cites consensus without describing its meaning and context, we disagree. Our references to consensus in the TSD and the Findings are consistently within the context of describing conclusions of the assessment literature upon which we rely, which are, in fact, consensus-based. The Web site (http://www.globalchange.gov/whats-new) for the recent USGCRP assessment (Karl et al., 2009) notes it represents "a consensus of 13 agencies developed over a year and half." In its report "Understanding and Responding to Climate Change," the National Academy of Sciences notes that in its NRC reports on climate change (which are cited in the TSD) they "have assessed consensus findings on the science, identified new avenues of inquiry and critical needs in the observing and computational research infrastructure, and explored opportunities to use scientific knowledge to more effectively respond to climate change." The 2005 Joint Science Academies' statement of 2005 states: "We recognize the international scientific consensus of the Intergovernmental Panel on Climate Change (IPCC)." For further information on the process involved for developing the consensus conclusions of the IPCC, please refer to comment # 1-14.

[2] http://www.ametsoc.org/sss/documents/climateletter.pdf

Comment (1-44):
To highlight uncertainty in the science, a number of commenters (0482.1, 0591, 0700.1, 3569.1, 3906,) reference the scientific testimony of the Right Honorable Christopher Walter Monckton, Third Viscount Monckton of Brenchley, before the Energy and Commerce Committee of the House of Representatives on March 25, 2009, and/or follow-on letter (addressed to Congressman Joe Barton and Congressman Edward Markey), which question the links between human activities and global warming (Monckton, 2009a, 2009b). One commenter (3906) requests EPA counter any flaws in the letter.

Response (1-44):
We respond to the relevant assertions in Lord Monckton's testimony and in his follow-up letter to Representatives Markey and Barton in the appropriate Response to Comment volumes. In his letter, Lord Monckton enumerates 50 "red flags" which represent scientific irregularities in statements or conclusions made by prominent climate scientists, in the assessment literature, and/or in our TSD. We address most of these, but note that some of the "red flags" apply specifically to statements made by individuals (e.g., Vice President Al Gore, scientists who testified before Congress, congressional members), which only they could reasonably respond to and which we found to be extraneous to the assessment literature and/or statements in the TSD.

Comment (1-45):
Two commenters (0152, 0718) voice their support for EPA's Proposed Findings and state that even if the full risks and implications of global warming cannot be quantified, EPA has enough information to take "concrete and serious steps."

Response (1-45):
We agree with the commenters that the state of the science is strong enough to support the Findings.

Comment (1-46):
Several commenters (2972.1, 3136.1, 3449.1, and 3747.1) argue that the TSD does not differentiate between the risks to various physical and biological systems specifically resulting from climate change and those due to other non-climate pressures including subsidence, land use, development, and population growth. Some commenters also state that the TSD overemphasizes climate change pressures, when in reality the non-climate pressures are the larger problem. The commenters conclude that because climate change is not the only cause of impacts to physical and biological systems and because climate change drivers cannot be measurably isolated from other non-climate drivers of impacts, this information cannot be used to support the endangerment finding. Commenter 3747.1 argues that EPA's treatment of these baseline assumptions do not meet information quality requirements under the IQA.

Response (1-46):
EPA disagrees with the commenters that the information summarized in the TSD does not differentiate between climate and non-climate drivers of impacts to physical and biological systems, or adequately isolate the observed effects and future risks and impacts attributable to elevated concentrations of GHGs and associated climate change, and this issue is addressed extensively throughout the TSD and in the Response to Comments document. For example, we describe in Section 5(b) of the TSD the importance of considering climate variability and non-climate drivers (e.g., land-use change, habitat fragmentation) in order to make robust conclusions about the role of anthropogenic climate change in affecting biological and physical systems. The discussions of climate impacts on the sectors described in Sections 7-15 of the TSD are also summarized with acknowledgement of the non-climate drivers. As an illustration, in

Sections 12 and 14, we summarize findings from the assessment literature which discuss impacts to coastal areas and ecosystems resulting solely from climate change or from the interaction of both climate change and non-climate-related stressors. The discussion in the TSD is clear that climate change effects on physical and biological systems do not occur in isolation, and that climate change, other stressors, and the compounded effects of both will present new threats while also compounding existing stressors.

Further, we disagree with the commenter's statement that our treatment of this issue is inconsistent with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*. For EPA's general response to the information quality concerns submitted during the public comment process, please see Section 5 of this volume. With respect to this specific issue raised by commenter 3747.1 we note that the *Guidelines* encourage risk assessments to analyze and consider 'real world situations.' EPA's approach of assessing climate change impacts independently but also in the context of other stressors is therefore consistent with the *Guidelines*. An example of this approach is seen in Section 12(a) of the TSD:

> Although climate change is impacting coastal systems, non-climate human impacts have been more damaging over the past century. The major non-climate impacts for the United States and other world regions include drainage of coastal wetlands, resource extraction[3], deforestation, introductions of invasive species, shoreline protection, and the discharge of sewage, fertilizers, and contaminants into coastal waters (Nicholls et al., 2007). The cumulative effect of these non-climate, anthropogenic impacts increases the vulnerability of coastal systems to climate-related stressors.

EPA also disagrees with the commenters that the TSD inappropriately emphasizes climate change pressures. In Section 5(b) of the TSD, we discuss how the IPCC (Rosenzweig et al., 2007) reviewed a number of studies that linked changes in some physical and biological systems directly to anthropogenic climate change. The IPCC concluded that the observed changes in physical and biological systems "likely cannot be explained entirely due to natural variability or other confounding non-climate factors" (Rosenzweig et al., 2007). Furthermore, future projections of climate change and associated risks and impacts in the TSD go even further to isolate the potential effects of climate change, where information from the underlying assessment literature often assesses the risks of climate change while holding current conditions constant. We therefore find that the TSD's treatment of climate and non-climate factors was reasonable and appropriately reflects the conclusions of the body of scientific literature.

See Response to Comments Volume 9 for our responses to comments on how specific climate impacts evidence was considered in the Administrator's endangerment finding.

Comment (1-47):
A commenter (3747.1) argues that EPA did not adhere to information quality guidelines on reproducibility and transparency because the TSD does not explain how EPA determined the probabilities assigned to climate science and impacts conclusions from the assessment literature. The commenter acknowledges that "adopts IPCC phraseology assessing the likelihood of results" but "never explains how it determined the probability."

Response (1-47):
Please see Volume 1: Section 5 of this Response to Comments document for EPA's general response to the information quality concerns submitted during the public comment process. Please see previous

[3] Resource extraction activities in coastal areas include sand/coral mining, hydrocarbon production, and commercial and recreational fishing.

responses to comments in this section regarding our use of the assessment literature's uncertainty and likelihood determinations in the TSD, as well as Section 1 of the TSD, which describes EPA's approach and use of lexicon developed by the IPCC, USGCRP, and CCSP for the consistent communication of uncertainty and likelihood. We note that in climate science, likelihood refers to a probabilistic assessment of some well-defined outcome having occurred or that will occur in the future (IPCC, 2007e). In this sense, likelihood and probability are one and the same. For example, when IPCC authors evaluated the likelihood of certain outcomes and determined then to be "very likely," the probability of occurrence was 90 to 99%.

Additional information has been added to Box 1.2 in Section 1 of the TSD to more fully describe our approach to the communication of uncertainty and probabilities. Additional detail on these issues is provided in prior responses, particularly with respect to the processes followed by IPCC and other assessment reports to develop the reports, which includes determining the uncertainty and likelihood category to assign to the various scientific issues discussed in the TSD.

Our characterization and treatment of uncertainty is consistent with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*. Conveying the same likelihood and probability terminology assigned to climate science findings by the IPCC and USGCRP/CCSP ensures that the information in the TSD is reproducible (the *Guidelines* state that "EPA intends to ensure reproducibility according to commonly accepted scientific, financial, or statistical standards") and transparent (the Guidelines state that "A higher degree of transparency about data and methods will facilitate the reproducibility of such information by qualified third parties, to an acceptable degree of imprecision").

Comment (1-48):
Two commenters (3577.1 and 3747.1) discuss how EPA, in general, failed to identify uncertainties in the studies that underlie EPA's Proposed Finding. Commenter 3747.1 argues that EPA did not adhere to information quality guidelines by not identifying sources of uncertainty in the climate impacts and models described in the TSD. Specifically, the commenter requests that EPA identify:

> The rationale for the Agency's decision not to identify each of the uncertainties and ranges in the studies and models that underlie its proposed endangerment finding.
> What impacts the calculation of recognized uncertainties and ranges would have on the outcome of the endangerment finding.

Response (1-48):
Please see Volume 1: Section 5 of this Response to Comments document for EPA's general response to the information quality concerns submitted during the public comment process. In addition, please see previous responses to comments in this section on EPA's treatment of uncertainty regarding specific issues in the TSD.

We disagree with the comment that the TSD does not identify uncertainties and present ranges for statements of observed and projected climate change. The TSD describes the assessment literature's conclusions regarding the state of the science, discusses key uncertainties with regards to specific climate science issues, and presents observations and projections in ranges based upon different emission scenarios and other factors specific to a particular climate science issue. For example, Section 6(b) of the TSD states:

> The full suite of SRES scenarios (given below) provides a warming range of 3.2°F to 7.2°F (1.8°C to 4.0°C) with an uncertainty range of 2.0°F to 11.5°F (1.1°C to 6.4°C). The

multi-model average warming and associated uncertainty ranges for the 2090–2099 period (relative to 1980–1999) for each scenario, as illustrated in Figure 6.7 are shown in Table 6.1:

Table 6.1: Multi-model Average Warming for the 2090-2099 Period		
Scenario	**Average Global Warming by End of Century Relative to ~1990**	**Uncertainty Range**
B1	3.2°F (1.8°C)	2.0°F to 5.2°F (1.1°C to 2.9°C)
A1T	4.3°F (2.4°C)	2.5°F to 6.8°F (1.4°C to 3.8°C)
B2	4.3°F (2.4°C)	2.5°F to 6.8°F (1.4°C to 3.8°C)
A1B	5.0°F (2.8°C)	3.1°F to 7.9°F (1.7°C to 4.4°C)
A2	6.1°F (3.4°C)	3.6°F to 9.7°F (2.0°C to 5.4°C)
A1FI	+7.2°F (+4.0°C)	4.3°F to 11.5°F (2.4°C to 6.4°C)

The wide range of uncertainty in these estimates reflects the different assumptions about future concentrations of GHGs and aerosols in the various scenarios considered by the IPCC and the differing climate sensitivities of the various climate models used in the simulations (NRC, 2001a; Meehl et al., 2007; Karl et al., 2009).

Given that the TSD conveys the uncertainty information associated with the assessment literature's conclusions, the commenter's request to identify each of the uncertainties and ranges in the studies and models that underlie the Findings is unnecessary. Our characterization and treatment of uncertainty is consistent with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*, because our approach maximizes objectivity (which the *Guidelines* define as "whether the disseminated information is being presented in an accurate, clear, complete, and unbiased manner, and as a manner of substance, is accurate, reliable, and unbiased"), utility (defined by the *Guidelines* as "usefulness of the information to the intended users"), and transparency (which allows for "the reproducibility of such information by qualified third parties, to an acceptable degree of imprecision").

Finally, since the TSD appropriately describes uncertainties and presents climate science information in ranges, we reject the commenter's request that EPA reassess the Endangerment Determination.

1.3 Treatment of Adaptation and Emissions Mitigation

Comment (1-49):
A number of commenters (e.g., 2898.1, 3136.1, 3261.1, 3332.1, 3347.1, 3481.1, 3482.1, 3509.1, 3536.2, 3747.1) state that the Proposal and TSD should have explicitly assessed the potential for adaptation to protect public health and welfare from climate change. These commenters argue that observed trends in measures of U.S. health and welfare during a time of increasing anthropogenic GHG emissions provide evidence of the potential for adaptation to counteract any negative impacts of climate change, and that EPA overestimated the negative impacts of future climate change by not considering the role of adaptation. A commenter (3126.1), for example, asserts that sensitivity to heat has been declining, air quality improving, crop yields increasing, and life spans increasing, and that all this indicates that "weather and climate are becoming less and less a negative factor in our overall health and welfare." According to the commenter, "Our adaptations have improved our ability to handle the negative consequences of weather while enjoying the positive ones."

In arguing that EPA's approach to adaptation was inadequate or inappropriate for purposes of an endangerment analysis, many commenters (e.g., 2898.1, 3136.1, 3261.1, 3332.1, 3347.1, 3394.1, 3482.1, 3509.1, 3536.2, 3596.1, 3702.1, 3704.2, 3705.1, 3747.1) criticize EPA's characterization in the Proposal of potential policy or societal responses to climate change as speculative. They argue that EPA assumes humans will remain passive without changing their behavior or attempting to ameliorate the impacts of climate change, while in reality adaptive measures are all but inevitable.

Two commenters (3347.1 and 3509.1) state: 1) that autonomous adaptation affects the severity of impacts; 2) that anticipatory adaptation affects the likelihood of impacts; and 3) that both should therefore have been considered in the Proposal. One of these commenters (3509.1) characterizes the decision not to consider adaptive effects as "erroneous and clearly arbitrary."

Finally, several commenters (e.g., 3332.1, 3536.2, and 3747.1) argue that EPA should explicitly consider not just potential adaptations but also mitigation strategies, including their potential to prevent harm. These commenters assert that it is unreasonable for EPA to assume that society will not undertake mitigation in future.

Response (1-49):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

Comment (1-50):
Two commenters (2898.1 and 3394.1) state that EPA should explicitly consider potential private adaptation and critiqued the following statement from the Proposal: "Just as the Administrator would not consider, for example, the availability of asthma medication in determining whether criteria air pollutants endanger public health, so the Administrator will not consider private behavior in the endangerment determination at hand." A commenter (3394.1) states that the argument is "not a relevant analogy to adaptation in the context of climate" and that the availability of asthma medication in determining whether criteria air pollutants endanger public health "is not comparable to evolutionary responses in natural ecosystems or to changes in human behavior that may prevent welfare or indirect health impacts from ever occurring at all." The commenter also states that "in a variety of other settings, EPA has promulgated regulations and implemented policies to encourage adaptive responses to what might have otherwise developed into adverse public health and welfare impacts."

A commenter (2898.1) equates EPA's decision not to consider potential private adaptation to a catch-22, stating that EPA's reasoning for not explicitly considering adaptation implies that if people are anticipated to be worse off, that constitutes endangerment, but if people are reasonably anticipated to be better off, albeit due to adaptation, that also constitutes endangerment. According to the commenter, this reasoning guarantees an endangerment finding regardless of the risks people actually face. The commenter additionally questions whether EPA's reasoning implies that we are all endangered, all the time, mentioning that there are very few places on Earth where people can be healthy and thriving without forms of private adaptation to climate such as clothing, shelter, and agriculture.

Response (1-50):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

The specific statement from the Proposal critiqued by commenters 2898.1 and 3394.1 is not included in the revised discussion of adaptation included in the finding, where we have provided additional clarification on our treatment of adaptation and mitigation (see Section III.C). The discussion of

adaptation and mitigation in Section III.C of the Findings encompasses our treatment of all forms of adaptation.

In any case, the commenter presents a false comparison, assuming that climate change combined with future adaptation would lead to people being better off. Nothing in the evidence before EPA or the comment would lead to that conclusion. The commenter also mischaracterizes EPA's position—EPA is not determining whether climate or climate change endangers people, assuming we remove all present social circumstances of housing, infrastructure, and the like. EPA's position is that while future adaptation or mitigation may well occur, it does not change the issue before EPA—does the air pollution endanger public health or welfare, without considering future planned adaptation or mitigation? The reasons for this approach are described in Section III.C. of the Findings.

Finally, when we do not respond to comments on specific adaption or mitigation issues in the various volumes of this Response to Comments document, it should not be interpreted as our agreeing with the assertions of the commenter. We are not responding because it is not relevant to the Findings; we are not agreeing or disagreeing with the commenter on those issues.

Comment (1-51):
Several commenters (3347.1, 3379.1, 3482.1, 3509.1, 3702.1, 3705.1) cite the following quotation from the TSD (itself a quotation from the CCSP report on human health): "The United States is certainly capable of adapting to the collective impacts of climate change." These commenters argue that the quotation is highly relevant to the likelihood and severity of public health– or welfare-related effects of climate change in the United States, that an endangerment analysis must seek to determine what type and extent of harm is likely to occur, and that this question cannot be answered while ignoring the role of adaptation.

Response (1-51):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

With respect to this specific quote, it is incorrect to interpret its inclusion in the TSD as evidence that there are not risks to health and welfare. Further, the commenters only included one sentence of the section from which the quotation was drawn. The following sentence in the TSD states: "However, there will still be certain individuals and locations where the adaptive capacity is less and these individuals and their communities will be disproportionally impacted by climate change." For EPA's responses to comments and literature provided on specific climate impacts summarized in the TSD, please refer to the appropriate Response to Comment volumes.

Comment (1-52):
A commenter (3347.1) asserts that it is inconsistent and arbitrary for EPA to consider autonomous adaptation trends by non-human life forms while disregarding human adaptation in reaching its conclusion. The commenter argues that the TSD selectively describes some adaptive responses that are likely to occur as a result of climate change, such as a shift of species to northern and higher elevations, while omitting potentially more important adaptive response. The commenter states that "EPA's decision to broadly exclude other adaptive responses, including autonomous and anticipatory adaptive responses that could undermine the proposed endangerment finding, is arbitrary and represents a bias at odds with an objective with an objective analysis of risks."

Response (1-52):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

The TSD summarizes key observations from the assessment literature regarding natural autonomous adaptation; however, the decision not to include information on planned adaptation in the TSD was not based on arbitrary or biased reasons. Autonomous adaptation[4] is distinct in several ways from potential planned adaptations and merits different treatment.

First, observed non-human autonomous adaptations are part of the physical changes among ecosystems and wildlife in response to climate change. Second, in contrast to planned adaptations, autonomous adaptations are not a conscious response by society to climatic stimuli. Rather, they are natural physical responses to changes in the climate that occur independently of any potential human responses, thus representing an important strand of physical evidence that global climate is changing.

There are cases in the TSD where some degree of human autonomous adaptation is accounted for. These cases occur where the literature on which the TSD relies already uses assumptions about autonomous adaptation when projecting the future effects of climate change. Such cases are noted in the document.

Comment (1-53):
A commenter (3702.1) asserts that other agencies routinely consider adaptive behavior in their regulatory decision-making and stated that NOAA recently considered the past and likely future responsible behavior of ribbon seals in deciding whether to list the seal species as threatened or endangered.

Response (1-53):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings. In addition, see the previous response to comments regarding autonomous adaptation.

We further note that the legal requirements governing an endangerment analysis under Section 202(a) of the CAA are distinct from those governing different types of actions undertaken by other agencies. Section II of the Findings discusses the criteria under Section 202(a), and Section III.C. discusses adaptation and mitigation.

Comment (1-54):
A commenter (3136.1) argues that the TSD's "use of [hurricane] Katrina as an 'adaptation is inadequate' example completely misses the point." The commenter states that Katrina "was in no way a climatologically remarkable storm in New Orleans" and was "more an indictment of government emergency response than our adaptive capacity."

Response (1-54):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

[4] IPCC defines autonomous adaptation as adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.

We note that the question of whether hurricane Katrina was "climatologically remarkable" is not germane to our reasons for determining that planned adaptation and mitigation are outside the scope of the endangerment finding. For discussion of hurricane Katrina in relation to climate change and climate change impacts, please refer to Sections 7(b), 12(a), 12(b), and 13(b) of the final TSD. For EPA's responses to comments on extreme weather events in relation to climate change, please refer to Volume 2, Section 2.6: "Extreme Weather Events," and Volume 4, Section 4.5, "Projections of Extreme Weather Events."

Comment (1-55):
Two commenters (2818 and 4036.5) state that adaptation is not sufficient to prevent harm from climate change. A commenter (2818) argues that adaptation is important but inadequate on its own. The commenter states that though they think adaptation is important, "all the adaptation in the world is not going to save us, unless we also work to get the climate stabilized." Another commenter (4036.5) states that there are some impacts of climate change for which adaptation is simply not an option and cited as an example injuries related to extreme weather events that are simply not treatable with medication.

Response (1-55):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

Comment (1-56):
A commenter (3747.1) argues that EPA ignored the potential impacts of adaptive behaviors or GHG mitigative actions in reducing impacts to humans and the environment, therefore not adhering to information quality guidelines. The commenter argues that EPA's lack of consideration on adaptation and mitigation resulted in vulnerabilities being overstated and conclusions that were biased and incomplete.

Response (1-56):
See Section III.C, "Adaptation and Mitigation," of the Findings and previous responses to comments in this section regarding EPA's treatment of adaptation and mitigation in the Findings. EPA has provided a high level of transparency and consistency in accordance with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency.* Through the clear description of our treatment of adaptation and mitigation in the Introduction of the TSD, we have been transparent and open with the approach used. This approach is also consistent with the *Guidelines* because the TSD was peer-reviewed by external climate science experts. Given our approach to the scientific literature (described in Section III.A of the Finding), the purpose of the federal expert review was to ensure that the TSD accurately summarized the conclusions and associated uncertainties from the assessment reports. Their unbiased and comprehensive review of the TSD revealed that our treatment of adaptation and mitigation was appropriate and sound, and that we appropriately applied and summarized the information from the assessment literature. This ensured that the climate change risk and impacts information was appropriately presented and that vulnerabilities were not overstated.

Comment (1-57):
Commenter 2898.1 cites a presentation by Indur Goklany (2006) to argue that mortality in the U.S. due to extreme weather events is currently below its peak levels of a few decades ago, and that a reversal of these trends is not reasonably anticipated, even if one assumes that global warming will affect extreme weather. The commenter agrees with EPA that heat waves are likely to become more intense but asserts

that more heat waves will not lead to more heat-wave related mortality, due to adaptive actions. The commenter cites a paper (Davis et al., 2003) which they claim shows that as urban air temperatures have increased, due to expanding urban heat islands, cities where hot weather is common have had practically no heat-related mortality.

Response (1-57):
See Section III.C, "Adaptation and Mitigation," of the Findings for our response to comments on the treatment of adaptation and mitigation in the Findings.

See Volume 5 of the Response to Comments document for EPA's response to the specific comments and literature provided on heat mortality and morbidity.

1.4 Consideration of Net (Adverse and Beneficial) Effects

Comment (1-58):
A number of commenters (e.g., 3384.1, 3411.1, 3440.1, 3449.1, 3473.1, 3481.1, 3530.1, 4395, 7020, 9636, 10144, 11315, 11449) argue that EPA failed to adequately identify and consider the potential benefits of elevated atmospheric GHG concentrations and climate change. One commenter (11315), for example, states: "EPA acknowledges that there are beneficial impacts from increase [sic] carbon dioxide (the dominant man induced greenhouse gas) but fails to adequately identify them or their significance." Other commenters (3283.1, 3324.1, and 3340) contend that the TSD contains biased language that focuses on the worst-case potential harm, over-emphasizes negative impacts, and has not adequately attempted to evaluate the potential benefits of climate change.

A number of commenters (e.g., 0400, 0401.3, 0455, 1216.1, 1561.1, 2157, 2750, 2883.1, 2893, 3071, 3214.1, 3261.1, 3261.2, 3307.1, 3395.1, 3722, A29, 8978.1, 10158, 1217.1, 11315, 11492) state that the benefits of elevated atmospheric GHG concentrations and climate change outweigh the adverse effects. Some of these commenters assert that climate change will result in net economic benefits for the United States. In addition, commenters describe a variety of sector-specific benefits that they believe will result from elevated atmospheric CO_2 concentrations and warming temperatures, including: reduced health impacts from cold temperatures that, according to commenters, could outweigh increased risks from heat (e.g., 0400, 0798, 3307.1, 3384.1, 3411.1, 4632R51, 9946, 11453.1); a potential for fewer tropical cyclones (e.g., 0400); positive effects on plant growth (e.g., 0455, 2883.1, 3061, 3214.1,); increased crop and food production (e.g., 0798, 1216.1, 1217.1, 1561.1, 3214.1, 3261.1, 3395.1, 4632R51, 10158, 9061.1); and decreases in heating use and costs (e.g., 2883.1, 4632R51). Several commenters (e.g., 3224) states that warming to date has been accompanied by increasing life spans, increases in GDP, and increases in food production/supplies despite increases in population. Another commenter (0700.1) asserts that temperature differentials that cause storms diminish with warming.

Response (1-58):
We reviewed the TSD in light of this comment, and find that the TSD summarizes both beneficial and adverse impacts, drawing from the findings in the assessment literature. The TSD includes information regarding potential benefits of warming with respect to heat- and cold-related mortality in Section 7; effects of elevated CO_2 concentrations on the agriculture and forestry sectors in Sections 9 and 10; and impacts of warmer temperatures for energy use, including heating requirements, in Section 13. Thus, EPA does not agree that the TSD contains biased language or does not provide a balanced and reasonable evaluation of both the beneficial and adverse impacts of climate change.

The impacts of changes in tropical cyclone activity are discussed in Section 7(b) of the TSD. Potential changes in storms are addressed in Section 6(e) of the TSD, and see also our responses to comment in Volume 4 of this Response to Comments document.

We received many comments and, in some cases, additional literature related to the characterization in the TSD of specific impacts associated with elevated atmospheric GHG concentrations. For EPA's responses to these comments, please refer to the appropriate Response to Comment volumes. For EPA's responses to comments pertaining to the method used by the Administrator to find endangerment, please refer to Volume 9.

Comment (1-59):
Several commenters (e.g., 0603.1, 3411.1, 3607.1, 3722, 10144) state that EPA did not explicitly enough quantify positive and negative effects from elevated GHG concentrations and climate change to adequately support the Proposed Findings. A commenter (3603.1), for example, states that EPA should more thoroughly characterize, using numbers and ranges, the health and welfare impacts. Another commenter (3722) states that EPA should have evaluated in detail, in a balanced and complete fashion, the net effect of warming temperatures in determining whether warming will result in adverse health effects, taking into account both the positive and negative impacts. Two commenters (3322.2, 10144) request that EPA assess and quantify the beneficial impact on climate change and the resultant improvements to public health/safety and welfare associated with regulating GHG emissions under the CAA.

Response (1-59):
We disagree that we did not explicitly enough quantify the effects of elevated GHG concentrations and associated climate change, including development of numbers and ranges. Our treatment of positive and negative effects from warming and other climatic changes is consistent with the assessment literature and fully appropriate for purposes of an endangerment finding. We quantified impacts where possible, but we did not do so in cases where it cannot be done in a scientifically rigorous manner. The assessment literature on which the TSD is primarily based does not numerically quantify the impact of every observed and projected change due to elevated GHG concentrations and associated climate change, nor does the TSD.

As demonstrated by the assessment literature, it is possible and useful to assign confidence levels to many impact statements, findings, and projections. For this reason, the TSD employs terminology consistent with the assessment reports upon which it is primarily based to communicate likelihoods and uncertainties for impacts in each sector (see Section 1.2 of this volume and Box 1.2 of the TSD for a discussion of communication of uncertainty in the IPCC and CCSP/USGCRP reports).

For a discussion of key issues the Administrator considered when evaluating the state of the science, including her consideration of the nature and potential magnitude of the impacts (both adverse and beneficial) across all climate-sensitive elements of public health and welfare, please refer to Volume 9 of this Response to Comments document and Section IV.B of the Findings. For EPA's responses to comments on impacts in specific sectors, please refer to the appropriate Response to Comment volumes.

1.5 Information Quality Act Requirements for Independent Assessment

Comment (1-60):

A number of commenters argue that EPA has not complied with the objectivity, utility, and integrity guidelines of the IQA and EPA *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the EPA.*[5] Many commenters went on to explain specific concerns regarding information quality, including EPA's use of the synthesis literature reports.

Response (1-60):
EPA has fully complied with the requirements of the IQA (also referred to as the Data Quality Act) and the CAA. The IQA requires the Office of Management and Budget and federal agencies to issue guidelines that "ensur[e] and maximize[e] the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies" (Public Law 106-554; 44 U.S.C. 3516, note). The IQA does not impose its own standard of "quality" on agency information; instead, it requires only that an agency "issue guidelines" ensuring data quality. Following guidelines issued by the Office of Management and Budget, EPA released its own guidelines to implement the IQA (http://www.epa.gov/QUALITY/informationguidelines/documents/EPA_InfoQualityGuidelines.pdf). These guidelines describe thorough mechanisms under which the Agency may review data quality. In addition to complying with the requirements of the IQA, EPA has acted consistently with the applicable information quality guidelines.

For EPA's responses to comments on specific information quality concerns raised by the commenters, please see responses in this Section, other sections in this Volume, and relevant Response to Comment volumes.

Comment (1-61):
One commenter (3747.1) argues that EPA has not complied with the IQA and submits 13 separate information quality concerns (labeled "requests for correction" by the commenter) related to the following topics: peer review; treatment of uncertainty and ranges; selection of cited studies; transparency of available data; transparency in observational data; transparency in model limitations; baseline assumption errors; adaptation/mitigation; defining likelihood; misapplication of IPCC storylines; availability of data; precipitation; and sea level rise. For each topic, the commenter provides an argument, along with specific information quality concerns regarding the data and information used in the TSD and Findings. In their submission, the commenter (3747.1) states: "We recognize that EPA has the right to respond to these findings with its response to comments as these RFCs [requests for correction] are being submitted within an open comment period. [The commenter] is willing to forego an individual response and, to the contrary, believes that stakeholders and the public would benefit from EPA's responses and corrections."

Response (1-61):
As a preliminary matter, other commenters, such as 3394.1, suggest that the comments were filed as "requests for correction" (RFCs) during this proposal. Any such RFCs in this instance have been treated as comments on the proposed rule and have been considered and addressed as such. The comments will not be assigned an RFC number by EPA.

Consistent with the statement of the commenter (3747.1), Section 8.5 of EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*, describes that if a group or an individual raises a question regarding information supporting a proposed rule, EPA generally expects to treat it procedurally like a comment to the rulemaking, addressing it in the response to comments rather than through a separate response

[5] *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency.* EPA/260R-02-008, October 2002.

mechanism. When EPA provides opportunities for public participation by seeking comments on information, the public comment process will generally address concerns about EPA's information. EPA believes that the thorough consideration provided by the public comment process for these Findings serves the purposes of the Guidelines, provides an opportunity for correction of any information that does not comply with the Guidelines, and does not duplicate or interfere with the orderly conduct of the action.

After careful review, EPA concluded that it is most appropriate to treat these 13 separate topics of concern as public comments and fully address them in the relevant volumes of the Response to Comments document. In many cases, other commenters raised analogous points and we have grouped these similar comments, where appropriate, for purposes of our response. Please see the following volumes of this Response to Comments document for our responses to these requests for correction:

Request for Correction: Peer Review	This section (1.5)
Request for Correction: Treatment of Uncertainty and Ranges	Volume 1: Section 2
Request for Correction: Selection of Cited Studies	This section (1.5)
Request for Correction: Transparency of Available Data	This section (1.5)
Request for Correction: Transparency in Observational Data	This section (1.5)
Request for Correction: Transparency in Model Limitations	Volume 4
Request for Correction: Baseline Assumption Errors	Volume 1: Section 2 Volume 3
Request for Correction: Adaptation/Mitigation	Volume 1: Section 3
Request for Correction: Defining Likelihood	Volume 1: Section 2
Request for Correction: Misapplication of IPCC Storylines	Volume 4
Request for Correction: Availability of Data	This section (1.5)
Request for Correction: Precipitation	Volume 2 Volume 7
Request for Correction: Sea Level Rise	Volume 2

The process used by EPA regarding the information that forms the basis for the Findings maximizes quality, utility, objectivity, and integrity of the information used. See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature. Therefore, and as further explained below, we have addressed these topics of concern consistent with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*.

Comment (1-62):
A number of commenters (0289, 3332.1, 3394.1, 3415.1, 3509.1, 3577.1, 3747.1, 7029, 10345, 10524, 10956, 11358.1, and 11466.1) argue that EPA did not make publically available the data, models, and other relevant information used in the studies upon which the endangerment determination was made. Several commenters (3577.1, 3747.1, and 10071.2) state that nearly half of the studies on which EPA relies for the Proposed Findings are unavailable in the docket due to copyright issues.

Response (1-62):
EPA is required to docket only the information on which it relies, and as explained Section III.A. of the Findings, and in this volume of the Response to Comments document, the Administrator is reasonably relying on the major assessments of the USGCRP, IPCC, and NRC as the primary scientific and technical basis of her endangerment decision. *See, e.g.,* American Trucking Ass'n v. EPA, 293 F.3d 355, 372 (D.C. Cir. 2002) ("ATA III") (EPA is not required to obtain and publicize the data underlying all the studies on which they rely.). See Section III.A. of the Findings, "The Science on Which the Decisions Are Based,"

for our response to comments on the use of the assessment literature. Further, as noted previously, Section 1(b) and Box 1.1 of the TSD provide a general description of the procedures followed by the IPCC and USGCRP/CCSP in developing their reports, and our responses to specific comments on these issues are provided in Section 1.1 of Volume 1 (this volume) of the Response to Comments document.

Where EPA used or described any data in the TSD, for example the GHG emissions data, the source of the data is listed, including where it can be accessed and downloaded. Further, each report, study, or dataset we relied upon has been placed in the Docket[6] for this Action. Information regarding the underlying data, models, and studies used by IPCC, USGCRP, CCSP, and NRC in developing their assessment reports can be accessed by consulting these reports. Given that some of these reports relied upon thousands of underlying studies, supplying every underlying study in the Docket would be unreasonable and unnecessary.

With respect to the comment regarding the reliance of copyrighted materials, we acknowledge that more than half of the scientific literature that EPA references in the TSD has copyright protections and is therefore unavailable for download from the Docket at regulations.gov. However, the public can review all documents used by EPA in developing the TSD by requesting a copy or visiting EPA's Air Docket. EPA practice regarding the availability of copyrighted materials is consistent with law. The online Docket provides the public with an explanation of why certain copyrighted material is not available for download and provides information on how to receive copies of the copyright protected material. The following message is posted for each copyrighted publication in the Docket:

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All sources of information from the assessment reports are clearly cited in the text of the TSD and listed in the references section. This approach ensures the high level of transparency and consistency that is encouraged by EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*, and will ensure "the reproducibility of such information by qualified third parties, to an acceptable degree of imprecision."

Comment (1-63):

[6] EPA Docket ID # EPA-HQ-OAR-2009-0171.

A commenter (3747.1) argues that EPA did not adhere to information quality guidelines under the IQA because it did not provide the following regarding the data and models used in the TSD:

> Raw data sets used in the analysis of the observational record.
> Algorithms used to correct, transform, or otherwise modify observational datasets.
> Missing data algorithms for all datasets.
> Datasets used to calibrate models.
> Model calibration results for models.
> Adjustments made to models as a result of calibration.

Response (1-63):
As previously noted, the IQA does not impose its own standards or establish any requirements regarding the quality of agency information; instead, it requires only that an agency "issue guidelines" ensuring data quality. EPA complied with the IQA by issuing its *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency* and has acted consistently with these Guidelines in developing these Findings.

As noted above, EPA is required to docket only the information on which it relies, and the Administrator is reasonably relying on the major assessments of the USGCRP, IPCC, and NRC as the primary scientific and technical basis of her endangerment decision. EPA did not conduct new research or modeling in developing the TSD, and instead relied upon the findings of the assessment literature, including data and modeling studies presented in those reports. The information mentioned by the commenter can be accessed by consulting these assessment reports and the underlying studies. For example, Lemke et al. (2007) describes that "The premier data set used to evaluate large-scale snow covered area (SCA), which dates to 1966 and is the longest satellite-derived environmental data set of any kind, is the weekly visible wavelength satellite maps of NH [Northern Hemisphere] snow cover produced by the US National Oceanic and Atmospheric Administration's (NOAA) National Environmental Satellite Data and Information Service (NESDIA; Robinson et al., 1993)." The *Guidelines* state: "For disseminated influential original and supporting data, EPA intends to ensure reproducibility according to commonly accepted scientific, financial, or statistical standards. It is important that analytic results for influential information have a higher degree of transparency regarding (1) the source of the data used, (2) the various assumptions employed, (3) the analytic methods applied, and (4) the statistical procedures employed." Our comprehensive referencing of the assessment literature ensures transparency regarding the source of the data used and the TSD clearly indicates assumptions (e.g., emissions scenarios), analytical methods, and statistical procedures where that information was necessary in describing the conclusions.

Comment (1-64):
A number of commenters (0169, 2972.1, 3187.1, 3286.1, 3297.1, 3307.1, 3332.1, 3347.1, 3372.1, 3394.1, 3415.1, 3481.1, 3579.1, 3596.1, 3705.1, 3722, 3747.1, 3748.1, 4446, 4766, and 9970) argue that EPA did not following IQA guidelines when it decided not to conduct a new analysis of the best available scientific information and instead relied upon IPCC and CCSP assessments.

Response (1-64):
See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," and Section 1.1 of this volume of the Response to Comments document, for our responses on the use of the assessment literature and EPA's decision not to conduct an additional and separate review of the underlying climate data and research.

EPA has determined that the approach taken provided the high level of transparency and consistency outlined by EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*. The *Guidelines* state: "Ensuring and maximizing the quality of information from States, other governments, and third parties is a complex undertaking, involving thoughtful collaboration with States, Tribes, the scientific and technical community, and other external information providers. EPA will continue to take steps to ensure that the quality and transparency of information provided by external sources are sufficient for the intended use." Our approach is consistent with these guidelines because we thoroughly reviewed and evaluated the author selection, report preparation, expert review, public review, information quality, and approval procedures of IPCC, USGCRP/CCSP, and NRC to ensure the information adhered "to a basic standard of quality, including objectivity, utility, and integrity." See responses to comments in Section 1 and Appendices A, B, and C of this Volume for additional information regarding the steps EPA took to ensure that the quality and transparency of information provided by these assessments. See Section III.A of the Findings for our rationale for why the assessment literature represents the best available scientific information regarding climate change.

Comment (1-65):
A commenter (3747.1) argues that they are unable to evaluate the strength of EPA's analysis of observational data because the TSD does not describe the "current state of observational data in detail, including uncertainties in data collection, data assembly, data processing, correction factors, and data set concatenations." The commenter argues that EPA did not conform to information quality guidelines.

Response (1-65):
As previously noted, the IQA does not impose its own standards or establish any requirements regarding the quality of agency information; instead, it requires only that an agency "issue guidelines" ensuring data quality. EPA complied with the IQA by issuing its *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency* and has acted consistently with these Guidelines in developing these Findings.

In developing the TSD, EPA primarily relied upon the findings of the assessment literature, including observational data and studies describing observed climate change impacts. We did not develop new observational data as part of this action, but rather summarized existing information from the assessment literature. The specific information regarding observational data mentioned by the commenter can be accessed by consulting these assessment reports and the underlying studies. This approach is consistent with EPA's *Guidelines*.

See Section III.A., "The Science on Which the Decisions Are Based," and Section 1.1 of this volume of the Response to Comments document, for our responses on the use of the assessment literature, our evaluation of the procedures for developing the IPCC and other assessment reports, the treatment of new and additional scientific studies received through the public comment process, and EPA's decision not to conduct an additional and separate review of the underlying climate data and research. See Section 1.2 of this volume for EPA's response to comments on the communication of uncertainties in the underlying assessment literature.

Comment (1-66):
A commenter (11466.1) describes that surface temperature data from the University of East Anglia's Climate Research Unit (CRU) was used by EPA in the TSD and that the raw data no longer exist, as only the quality-controlled and homogenized data was retained by CRU. The commenter argues that use of this

data violates EPA's information quality guidelines, as the public is unable to access, assess, and verify the data.

Response (1-66):
EPA's response to this comment is provided in Volume 2: Section 2 of this Response to Comments document.

Comment (1-67):
A number of commenters (0169, 0797, 2972.1, 3053, 3136.1, 3187.1, 3187.4, 3286.1, 3297.1, 3307.1, 3332.1, 3347.1, 3372.1, 3394.1, 3415.1, 3481.1, 3509.1, 3596.1, 3597.1, 3679.1, 3705.1, 3722, 3747.1, 3748.1, 3764.1, 3769.1, 4766, 10388) argue that EPA did not adhere to information quality guidelines in using IPCC, CCSP, and NRC reports as the basis of the endangerment finding. Most of these comments argue that EPA did not consider all relevant information before proposing the findings and failed to be transparent regarding the Agency's process for evaluating and considering scientific literature in developing the Proposed Findings. Commenter 3747.1 argues that EPA should more clearly describe the process used in selecting studies and information which were cited in the TSD.

Response (1-67):
EPA has clearly explained how it evaluated and considered scientific literature, and therefore has adhered to the information quality guidelines, as further explained in the Findings and the Response to Comments document. See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," and Section 1.1 of this volume of the Response to Comments document, for our responses on the use of the assessment literature as scientific basis in the TSD, our evaluation of the procedures used by IPCC, USGCRP, CCSP, and NRC in developing the assessment reports, the treatment of new and additional scientific studies received through the public comment process, and EPA's decision not to conduct an additional and separate review of the underlying climate data and research . See Section IV of the Findings for detailed discussion of how the Administrator reached her determination. This section of the Findings was substantially expanded in response to comments.

Comment (1-68):
Several commenters (0322, 3286.1, 3297.1, 3330.1, 3379.1, 3394.1, 3415.1, 3705.1, and 3764.1) argue that EPA has not shown that the IPCC's information quality process is equivalent to requirements under the IQA.

Response (1-68):
As previously noted, the IQA does not impose its own standards or establish any requirements regarding the quality of agency information; instead, it requires only that an agency "issue guidelines" ensuring data quality. EPA complied with the IQA by issuing its *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency* and has acted consistently with these Guidelines in developing these Findings.

See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our responses on the use of the assessment literature and our evaluation of the procedures used by IPCC, USGCRP, CCSP, and NRC in developing the assessment reports. As thoroughly discussed in our response to comment 1-14, the IPCC process for preparation and review of its reports demonstrate a formal and sustained commitment to transparency and rigor in report development, review, and acceptance and approval. The assessment reports we used in developing the TSD represent the best available science and

supporting studies conducted in accordance with sound and objective scientific practices, are peer reviewed, and adhere to standards of quality based on objectivity, utility, and integrity.

Comment (1-69):
Several commenters (2972.1, 3136.1, 3307.1, 3679.1, 3747.1, 3748.1, and 3764.1) argue that EPA failed to evaluate and incorporate climate science studies more recent than those employed by IPCC and CCSP.

Response (1-69):
The commenters' assertion is incorrect. See Section III.A. of the Findings, "The Science on Which the Decisions Are Based," for our response to comments on the use of the assessment literature and Section 1.1 of this Volume for our responses to comment regarding our treatment of new and additional scientific literature provided through the public comment process. For EPA's responses to comments and literature provided on specific climate science issues in the TSD, please refer to the appropriate Response to Comment volumes.

Comment (1-70):
Several commenters (3187.1, 3332.1, 3372.1, 3394.1, 3415.1, 3509.1, 3577.1, and 3747.1) argue that EPA did not to utilize an independent and objective peer review process and therefore failed to adhere to information quality guidelines under the IQA. Commenters argue that using federal experts involved with the development of IPCC, USGCRP, CCSP, and NRC reports to review the TSD was inappropriate because they do not represent an objective, independent perspective. One commenter argues that EPA did not describe how the federal experts were chosen and why this process was appropriate.

Response (1-70):
Please refer to Section 1.1 of this volume for EPA's response to comments regarding the review of the TSD, including the role of the federal expert review and why these reviewers were chosen. The 'Peer Review Policy' section (4.2) of the *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency* states:

> EPA's Peer Review Policy provides that major scientifically and technically based work products (including scientific, engineering, economic, or statistical documents) related to Agency decisions should be peer-reviewed. Agency managers within Headquarters, Regions, laboratories, and field offices determine and are accountable for the decision whether to employ peer review in particular instances and, if so, its character, scope, and timing. These decisions are made consistent with program goals and priorities, resource constraints, and statutory or court-ordered deadlines. For those work products that are intended to support the most important decisions or that have special importance in their own right, external peer review is the procedure of choice.

Given our approach to the scientific literature (described in Section III.A of the Findings), the purpose of the federal expert review was to ensure that the TSD accurately summarized the conclusions and associated uncertainties from the assessment reports. This peer-review approach for the TSD is consistent with EPA's *Guidelines* because: 1) the reviewers contributed significantly to the body of climate change literature and played active roles in IPCC and CCSP—therefore making them experts on various aspects of climate science and very familiar with the underlying literature and state of the science, 2) the federal climate change experts represent a range of technical specialties that span the range of topics covered in the TSD and covered by the range of topics that the Administrator needed to consider, 3) the federal experts offered unbiased and objective review because they were external and therefore not involved with

the development of the TSD[7], and 4) the TSD clearly identifies the Federal expert reviewers (as it did in the version of the TSD for the Proposed Findings), which ensures transparency.

Comment (1-71):
Several commenters (3187.4, 3307.1, 3372.1, 3729.1, and 3764.1) argue that EPA dismissed significant comments, criticisms, or suggested data/studies received through the ANPR without demonstrating why they were not considered.

Response (1-71):
Please see Section 1.1 of this volume for response to comments on how EPA reviewed and considered public comments submitted on the ANPR.

Comment (1-72):
Two commenters (3136.1 and 3446.2) argue that the USGCRP's assessment report "Global Climate Change Impacts in the United States" does not comply with the IQA. A commenter (3347.1) argues that EPA failed to describe how the CCSP ensured that the 21 synthesis and assessment products, rather than the documents on which it relied, satisfied EPA's IQA guidelines.

Response (1-72):
Please see Section 1.1 of this volume for response to comments regarding the procedures that governed development of the USGCRP and CCSP reports. The foundation of the USGCRP's June 2009 assessment report is the set of 21 CCSP SAPs, which were designed to address key policy-relevant issues in climate science. All 21 SAPs met federal requirements pertaining to the IQA. Furthermore, the unified synthesis report was extensively reviewed and revised based on comments from experts and the public. The report was approved by its lead USGCRP agency, NOAA, the other USGCRP agencies, and the Committee on the Environment and Natural Resources on behalf of the National Science and Technology Council. The unified synthesis product complies with the IQA and is consistent with EPA's information quality guidelines.

Regarding the information quality procedures for the individual SAPs, the CCSP provided strict guidance for the development and review of the 21 SAPs. The 'Information Quality Procedures' section of the *Guidance to Agency Leads Regarding the Preparation of CCSP Synthesis and Assessment Products* states:

> As a lead agency for an SAP, you will be responsible for complying with the Information Quality Act. Section 515 of Public Law 106-554, known as the Data Quality Act, required the Office of Management and Budget to promulgate guidance to agencies ensuring the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by Federal agencies. OMB's government-wide guidelines, published as interim final on September 28, 2002 (66 F.R. 49718) and finalized on February 22, 2002 (67 F.R. 8452), can be found on OMB's OIRA's Web site http://www.whitehouse.gov/omb/inforeg/agency_info_quality_links.html.
>
> To facilitate any requests that might ensue pursuant to this statute, it is a good idea that you advise each of your authors to:

[7] We note that 11 of the 12 federal expert reviewers do not work at EPA. The one EPA reviewer was not involved in the development of the TSD and therefore was an objective, unbiased reviewer.

a. Retain a copy of any document they cite;
b. Identify specific pages in the literature they cite, where appropriate; and
c. Use explanatory footnotes when the text extends beyond a fact cited in the literature.

Each product team should also be prepared to make available any data it uses in the report's charts or figures. These data should be publicly available as early as the expert review and public comment phases and should remain available thereafter.

The National Science and Technology Council, a Cabinet-level council that coordinates science and technology research across the federal government, reviewed and approved each report, including the steps taken by the lead agency to ensure that its information quality guidelines were followed. Further information clearance, review, and data quality procedures for the CCSP SAPs can be found in Appendix B. This process was robust, objective, transparent, and complete and ensured that the USGCRP and CCSP reports summarized in the TSD were consistent with the IQA *Guidelines*.

Comment (1-73):
Several commenters (3509.1, 3577.1, 3596.1, 3747.1, 3748.1, 3764.1, 3769.1, and 11358.1) argue that EPA did not discuss or reference scientific studies that do not support the Agency's conclusion that GHG emissions endanger human health and welfare.

Response (1-73):
Please see Section 1.1 of this volume for responses to comments regarding EPA's consideration of studies and information, including those which offered alternative views to the findings of the assessment literature.

Comment (1-74):
Two commenters (3397 and 3415.1) suggest that EPA ensure that it complies with the IQA and similar EPA guidelines in future actions regarding climate change policy.

Response (1-74):
As noted above, EPA has complied with the IQA by issuing guidelines that ensure and maximize the quality, objectivity, utility, and integrity of the information the Agency disseminates. In developing the Proposal, the TSD, and this Action, EPA developed and prepared the information in a manner that is consistent with EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency*. EPA intends to continue to act consistently with the IQA and its guidelines in future actions.

Comment (1-75):
Two commenters (3347.1 and 3764.1) suggest that in issuing a final finding, EPA employ information and data quality standards pursuant to those under the Safe Drinking Water Act (SDWA).

Response (1-75):
Unlike the IQA, the 1996 Amendments to the SDWA[8] added specific information requirements for decisions under SDWA based on science that is used to establish federal drinking water standards for

[8] Safe Drinking Water Act Amendments of 1996, 42 U.S.C. 300g-1(b)(3)(A) & (B).

public water systems. The information quality standards of the SWDA Amendments were adapted into EPA's *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility and Integrity of Information Disseminated by the Environmental Protection Agency.* The SDWA obligations do not apply to this action. However, EPA has acted consistently with its information quality guidelines. Section 6.4 of EPA's Guidelines states that:

> In our dissemination of influential scientific information regarding human health, safety or environmental risk assessments, EPA will ensure, to the extent practicable and consistent with Agency statutes and existing legislative regulations, the objectivity of such information disseminated by the Agency by applying the following adaptation of the quality principles found in the Safe Drinking Water Act (SDWA) Amendments of 1996:
>
> (A) The substance of the information is accurate, reliable and unbiased. This involves the use of:
> (i) The best available science and supporting studies conducted in accordance with sound and objective scientific practices, including, when available, peer reviewed science and supporting studies; and
> (ii) Data collected by accepted methods or best available methods (if the reliability of the method and the nature of the decision justifies the use of the data).
>
> (B) The presentation of information on human health, safety, or environmental risks, consistent with the purpose of the information, is comprehensive, informative, and understandable. In a document made available to the public, EPA specifies:
> (i) Each population addressed by any estimate of applicable human health risk or each risk assessment endpoint, including populations if applicable, addressed by any estimate of applicable ecological risk;
> (ii) The expected risk or central estimate of human health risk for the specific populations affected or the ecological assessment endpoints, including populations if applicable;
> (iii) Each appropriate upper-bound or lower-bound estimate of risk;
> (iv) Each significant uncertainty identified in the process of the assessment of risk and studies that would assist in resolving the uncertainty; and
> (v) Peer-reviewed studies known to the Administrator that support, are directly relevant to, or fail to support any estimate of risk and the methodology used to reconcile inconsistencies in the scientific data.

EPA followed has followed its information quality guidelines in developing the Findings. We relied on the best available peer-reviewed science, supporting studies conducted in accordance with sound and objective scientific practices, and data collected by accepted or best available methods. The Agency also has presented the information in a manner that is comprehensive, informative, and understandable.

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