**EPA's Denial of Petitions Relating to the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act**

The Environmental Protection Agency (EPA) is denying four petitions received between 2017 and 2019 regarding the Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act. This decision document sets forth the basis for this action. The Findings were signed by the Administrator on December 7, 2009. On January 19, 2021, the EPA denied all four petitions with a very brief discussion. On March 23, 2021, the EPA withdrew that denial of the petitions as the response did not provide adequate justification and indicated the intent to reassess the petitions and issue a new decision. EPA has carefully reviewed all of the petitions, including any supporting information submitted by petitioners, and reviewed both the scientific record and the Administrator's decision process underlying the 2009 Endangerment Finding in light of these petitions. EPA's analysis of the petitions concludes that the petitioners have provided inadequate, erroneous, and deficient arguments and evidence for their assertions that the underlying science supporting the 2009 Endangerment Finding is flawed, misinterpreted, or inappropriately applied by EPA. Thus, EPA concludes that these assertions do not warrant reconsideration of, or initiating rulemaking to revisit, the 2009 Endangerment Finding. Similarly, after reviewing the petitioners' assertions about flaws in the process or approach that was used to develop the 2009 Endangerment Finding, EPA disagrees that reconsideration or reopening of the 2009 Endangerment Finding is warranted on those grounds. The science supporting the Administrator's finding that elevated concentrations of greenhouse gases in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future U.S. generations is robust, voluminous, and compelling, and has been strongly affirmed by recent scientific assessments of the National Academies, the US Global Change Research Program, and the Intergovernmental Panel on Climate Change. In addition, petitioners' claims regarding both science and process are similar in nature and scope to those previously addressed by EPA in responding to public comments on the proposed Endangerment Finding, in denying prior petitions for reconsideration of the 2009 Endangerment Finding, and during judicial review of the 2009 Endangerment Finding, which were resolved in the 2012 decision of the U.S. Court of Appeals for the District of Columbia Circuit upholding the 2009 Endangerment Finding.

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# I. Introduction

EPA is denying four petitions regarding the Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act ("2009 Endangerment Finding") (74 Fed. Reg. 66496, December 15, 2009), which are styled respectively as:

- Petition for Reconsideration of "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(A) of the Clean Air Act," submitted on behalf of the Concerned Household Electricity Consumers Council (CHECC) and seven individuals via a letter dated February 1, 2017;
- Petition for Rulemaking on the Issue of Greenhouse Gases and Public Health and Welfare, submitted on behalf of the Competitive Enterprise Institute, the Science and Environmental Policy Project, and four individual members of the latter's Board of Directors (CEI) in February of 2017;
- Petition to Reopen and Reconsider "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," filed by the FAIR Energy Foundation (FAIR), received in May of 2019; and
- Petition to Reconsider Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66496 (December 15, 2009) Docket No. EPA-HQ-OAR-2009-0171; FRL-9091-8; RIN 2060-ZA14 ("Endangerment Finding") submitted by the Texas Public Policy Foundation on behalf of Liberty Packing Company LLC, Nuckles Oil Co., Inc. dba Merit Oil Company, Norman R. "Skip" Brown, Dalton Trucking Company, Inc., Loggers Association of Northern California, Construction Industry Air Quality Coalition, and Robinson Industries, Inc (TPP), dated May 1, 2017.

Between 2017 and 2019, EPA received these four petitions, which ask the Agency either to reconsider or to initiate rulemaking in connection with the 2009 Endangerment Finding. Some petitioners also made supplemental submissions after submitting their original petition.[1] On January 19, 2021, the EPA denied all four petitions with a very brief discussion. On March 23, 2021, the EPA withdrew that denial of the petitions as the response did not provide adequate justification and indicated the intent to reassess the petitions and issue a new decision. In the intervening time, EPA has carefully considered all four petitions, including the arguments presented therein and the supplemental submissions and any information provided by the petitioners as supporting evidence of their claims (collectively "petitions"). EPA has evaluated the merit of the petitioners' arguments in the context of the larger body of scientific and other relevant information available to the Agency, such as information in the record for the 2009

[1] CHECC submitted seven supplements to the original petition between May 2017 and June 2021. Five of the supplements provide additional arguments, and the other two include lists of 88 signatories who expressed support for reconsideration of the 2009 Endangerment Finding and offered to assist in preparing a new Endangerment Finding assessment. Eight exhibits were submitted with the TPP petition.

Endangerment Finding. This response (hereafter "Denial" or "Decision") provides EPA's scientific and legal justification for denying these four petitions.

In general terms, some of these petitions argue that recent revelations show that the science supporting EPA's 2009 Endangerment Finding was flawed or questionable, and that EPA should therefore reconsider, reopen, or revise the 2009 Endangerment Finding. Other petitions raise process concerns regarding the approach used in developing the 2009 Endangerment Finding and supporting documents. After a comprehensive, careful review and analysis of the petitions, EPA has determined that the petitioners' arguments and evidence are inadequate, erroneous, and do not show that the underlying science supporting the 2009 Endangerment Finding is flawed, misinterpreted by EPA, or inappropriately applied by EPA. Rather, the science supporting the Administrator's finding that elevated concentrations of greenhouse gases in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future U.S. generations is robust, voluminous, and compelling. This conclusion has been strongly affirmed by recent scientific assessments of the National Academies, the US Global Change Research Program, and the Intergovernmental Panel on Climate Change. As explained further below, EPA concludes that these assertions do not warrant reconsideration or initiating rulemaking to reopen the 2009 Endangerment Finding. Similarly, after reviewing the petitioners' assertions about flaws in the process or approach that was used to develop the 2009 Endangerment Finding, EPA disagrees that reconsideration, reopening or revision of the Finding is warranted on those grounds.

The petitioners' arguments and claims are similar in nature and scope to those addressed in the previous Response to Comments for the 2009 Endangerment Finding ("RTC"), as well as the 2010 Response to Petitions for Reconsideration ("RTP"), and the 2012 decision by the United States Court of Appeals for the District of Columbia Circuit ("D.C. Circuit"), which upheld the 2009 Endangerment Finding against numerous challenges, ultimately concluding that it "is consistent with *Massachusetts v. EPA* and the text and structure of the CAA, and is adequately supported by the administrative record." *Coalition for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102, 117 (D.C. Cir. 2012) (per curiam) (subsequent history omitted). In that decision, the court denied all the petitions for review of the 2009 Endangerment and Cause or Contribute Findings. *Id*. at 113-114. Much like comments and petitions previously considered and addressed by EPA, the petitioners rely on faulty statistical arguments, studies that have not gone through peer review, mischaracterizations of the science upon which EPA relied in developing the 2009 Endangerment Finding, and cherry-picked trends for individual metrics over short time periods and in small geographic regions, while ignoring the larger breadth of the climate science literature.

As discussed in detail throughout this Decision, petitioners' claims and the information they submit do not change or undermine our understanding of how anthropogenic emissions of greenhouse gases cause climate change and how human-induced climate change generates risks and impacts to public health and welfare, which provides the basis for the 2009 Endangerment Finding. This understanding has been decades in the making and has become more clear over time with the accumulation of evidence. The information provided by petitioners does not undermine any of the scientific conclusions that underlie the 2009 Endangerment Finding, nor do

the petitions lower the degrees of confidence associated with each of these major scientific conclusions.

More specifically, the petitions and the evidence they present do not persuade EPA that there is any reason to question the judgments and ultimate determination made in the 2009 Endangerment Finding based on the record available at that time. Moreover, as the EPA has explained in subsequent actions, information that has become available since 2009 "strengthen[s] and further support[s] the judgment that GHGs in the atmosphere may reasonably be anticipated to endanger the public health and welfare of current and future generations." 81 Fed. Reg. 54424 (Aug. 15, 2016). Furthermore, none of the information presented in the petitions demonstrates that revisiting the agency's prior understanding of the following key areas of greenhouse gas and climate change science is warranted: (1) That current and historic anthropogenic emissions of greenhouse gases are causing concentrations of greenhouse gases in our atmosphere to rise to elevated levels essentially unprecedented in human history; (2) that the accumulation of greenhouse gases in our atmosphere is exerting a warming effect on the global climate; (3) that warming of the climate system is unequivocal, as is evident from multiple types of observations, including increasing average global surface temperatures, rising ocean temperatures and sea levels, and shrinking Arctic sea ice, and that the observed rate of climate change stands out as significant compared to recent historical rates of climate change; (4) that there is compelling evidence that anthropogenic emissions of greenhouse gases are the primary driver of recent observed increases in average global temperature; (5) that without substantial efforts to reduce emissions, greenhouse gas concentrations are expected to continue to climb, leading to greater rates of future climate change relative to historic rates; and (6) that the threat to public health will likely mount over time as greenhouse gases continue to accumulate in the atmosphere and result in ever greater rates of climate change (74 Fed. Reg. 66517-66518, 66524).

The 2009 Endangerment Finding was based on a close and comprehensive scrutiny of the science, as reflected in the major science assessments, and thus decisions about whether to reopen these Findings should not be based on a small number of reports, most of which were not peer reviewed, and that do not conform to sound scientific principles. In this regard, the petitioners' arguments regarding the scientific underpinnings of the 2009 Endangerment Finding amount to a request that EPA ignore the deep body of science that has been built up over several decades, and reopen, reconsider, or revise the 2009 Endangerment Finding based not on a careful and comprehensive analysis of the science and literature, but instead on what amount to assertions and leaps in logic based on inadequate, cherry-picked evidence that does not meet important standards for quality and peer review. In addition, while some petitions raise process concerns regarding the approach used in developing the 2009 Endangerment Finding and supporting documents, none of the petitions persuasively demonstrate that additional procedures are warranted or would be appropriate at this point. Because the petitions do not provide any substantial support for the argument that the 2009 Endangerment Finding should be reconsidered, reopened, or revised, as described more fully below, EPA is denying these petitions.

# II. Background on the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act

In *Massachusetts v. EPA*, 549 U.S. 497 (2007), a case arising from EPA's denial of a petition for rulemaking to regulate GHGs under CAA section 202(a), the Supreme Court held that GHGs are air pollutants within the meaning of the CAA and thus can be regulated under the CAA. *Id.* at 532.The Court further concluded that in responding to the petition the Administrator needed to determine whether emissions of GHGs from new motor vehicles cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. *Id.* at 532-533. The Court explained that EPA could not avoid its obligations under section 202(a) "by noting the uncertainty surrounding various features of climate change and concluding that it would therefore be better not to regulate at this time," while clarifying that if "the scientific uncertainty is so profound that it precludes EPA from making a reasoned judgment as to whether greenhouse gases contribute to global warming, EPA must say so." *Id.* at 534. The Court further explained that in making these scientific findings and describing its reasons for action or inaction, the agency was bound by the provisions of section 202(a) of the CAA and that EPA's decision must relate to whether an air pollutant "causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare."[2] *Id.* at 532-533.

Following that decision, the EPA published an Advance Notice of Proposed Rulemaking (ANPRM) on July 30, 2008 presenting information relevant to potentially regulating GHGs under the Act and soliciting public comment on how to respond to the Court's ruling and the potential ramifications of the Agency's decision to regulate GHGs under the CAA (73 Fed. Reg. 44354, 44468–73).[3]

On April 24, 2009, the EPA proposed endangerment and cause or contribute findings for six well-mixed greenhouse gases under section 202(a) of the Clean Air Act, which were addressed collectively as a single air pollutant. 74 Fed. Reg. 18886 (April 24, 2009).[4] EPA held a 60-day public comment period, which ended June 23, 2009, and received over 380,000 public comments. After careful review and consideration of these comments, the EPA published final Endangerment and Cause or Contribute Findings under section 202(a) of the Clean Air Act on

[2] The Supreme Court decision can be found here: https://www.supremecourt.gov/opinions/06pdf/05-1120.pdf.

[3] The 2008 ANPRM, which described and solicited comment on numerous petitions the Agency had received to regulate GHG emissions from both stationary and mobile sources, can be found here: https://www.gpo.gov/fdsys/pkg/FR-2008-07-30/pdf/E8-16432.pdf.

[4] The proposed finding can be found here: https://www.gpo.gov/fdsys/pkg/FR-2009-04-24/pdf/E9-9339.pdf. The EPA held a 60-day public comment period which ended June 23, 2009 and two public hearings, and received over 380,000 comments.

December 15, 2009 (74 Fed. Reg. 66496):[5] An extensive 11-volume Response to Comments document accompanied the final agency action.

- Endangerment Finding: The Administrator found that the then current and projected concentrations of the combined mix in the atmosphere of the six well-mixed GHGs—$CO_2$, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—endanger the public health and welfare of current and future generations.
- Cause or Contribute Finding: The Administrator found that the combined emissions of the six well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution which threatens public health and welfare.

These findings did not themselves impose any requirements on industry or other entities.[6] Following publication of the final 2009 Endangerment Finding, EPA received 10 petitions to reconsider the Finding. After careful review and consideration of the arguments and evidence submitted, the EPA denied these 10 petitions for reconsideration on July 29, 2010.[7]

On June 26, 2012, the D.C. Circuit in *Coalition for Responsible Regulation, Inc. v. EPA* denied all the petitions for review of the 2009 Endangerment and Cause or Contribute Findings. 684 F.3d 102 (D.C. Cir. 2012) (per curiam), *reh'g denied* 2012 U.S. App. LEXIS 26313, 26315, 25997 (D.C. Cir. 2012). Petitions for *certiorari* were filed in the Supreme Court, and on October 15, 2013, the Supreme Court granted six of those petitions but "agreed to decide only one question: 'Whether EPA permissibly determined that its regulation of greenhouse gas emissions from new motor vehicles triggered permitting requirements under the Clean Air Act for stationary sources that emit greenhouse gases.'" *Utility Air Reg. Group v. EPA*, 134 S. Ct. 2427, 2438 (2014); *see also Virginia v. EPA*, 134 S. Ct. 418 (2013), *Pac. Legal Found. v. EPA*, 134 S. Ct. 418 (2013), and *Coalition for Responsible Regulation, Inc. v. EPA*, 134 S. Ct. 468 (2013) (all denying cert.). Thus, in granting further review on that single issue, the Supreme Court did not disturb the D.C. Circuit's holding that affirmed the 2009 Endangerment Finding. A fuller summary of the background of the 2009 Endangerment Finding can be found at 81 Fed. Reg. 54422, 54425-26, 54434-35 (August 15, 2016).

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[5] The Finding and 11 response to comment volumes, covering a broad range of scientific, technical, review process and administrative issues, and other matters raised by the public, can be found here: https://www.gpo.gov/fdsys/pkg/FR-2009-12-15/pdf/E9-29537.pdf, https://www.epa.gov/ghgemissions/appendices-and-pdf-versions-epas-response-public-comments-proposed-endangerment-and.

[6] These findings did compel the EPA to promulgate GHG emission standards for new motor vehicles under section 202(a), and the Agency has issued several such emissions standards since May of 2010, when it, in collaboration with the National Highway Traffic Safety Administration, finalized the first GHG emission standards for light-duty vehicles (2012–2016 model years). 75 Fed. Reg. 25324 (May 7, 2010).

[7] The 10 petitions for reconsideration of the 2009 Finding and the Agency denial can be found here: https://www.epa.gov/climate-change/denial-petitions-reconsideration-endangerment-and-cause-or-contribute-findings

For additional context, we note that on August 15, 2016, the EPA issued similar findings under a different provision of the Clean Air Act. Specifically, EPA finalized the "Finding that Greenhouse Gas Emissions from Aircraft Cause or Contribute to Air Pollution that May Reasonably Be Anticipated to Endanger Public Health and Welfare." 81 Fed. Reg. 54422.[8] That action included two findings under section 231(a)(2)(A) of the CAA. These findings were that: (1) Elevated concentrations of the six well-mixed GHGs in the atmosphere—$CO_2$, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride—endanger the public health and welfare of current and future generations within the meaning of CAA section 231(a)(2)(A) (the endangerment finding), and (2) emissions of the aggregate group of those same six GHGs from certain classes of engines used in certain aircraft are contributing to the air pollution—the mix of those GHGs in the atmosphere—that endangers public health and welfare under CAA section 231(a)(2)(A) (the cause or contribute finding, or contribution finding).[9] The EPA explained that it was "following the same approach toward technical and scientific information in this finding under section 231(a)(2)(A) as it used in the 2009 Endangerment Finding." 81 Fed. Reg. 54440. Thus, in the context of the 2016 Findings, EPA reviewed a number of new major peer-reviewed scientific assessments that had been released since 2009, finding that "these new assessments are largely consistent with, and in many cases strengthen and add to, the already compelling and comprehensive scientific evidence detailing the role of the six well-mixed GHGs in driving climate change, explained in the 2009 Endangerment Finding." 81 Fed. Reg. 54442; *see also id.* at 54434.

# III. Legal Framework for Review of Petitions

The four administrative petitions addressed in this denial are variously framed as petitions for reconsideration or petitions for rulemaking regarding the 2009 Endangerment Finding. The petitions also variously invoke different legal authorities, including section 307(d)(7)(B) of the CAA, the Administrative Procedure Act at 5 U.S.C. 553(e) (APA), and the First Amendment of the U.S. Constitution. For purposes of providing a complete response, EPA is evaluating all of these petitions as petitions for rulemaking under the APA[10] and evaluating those petitions that invoke CAA section 307(d)(7)(B) also as petitions for reconsideration under that section. Given the ambiguities and inconsistencies in the petitioners' legal claims, EPA reserves its right to argue on judicial review that each petitioner has failed to adequately invoke the proper legal authority for its petition.

[8] Available at https://www.gpo.gov/fdsys/pkg/FR-2016-08-15/pdf/2016-18399.pdf

[9] Prior to finalization, EPA informed the Science Advisory Board (SAB) of this action and provided it an opportunity to review this approach to the underlying technical and scientific information supporting the action. A copy of the Science Advisory Board's letter to EPA that memorializes its decision not to undertake such a review can be found in the docket for the 2016 Findings under Section 231(a)(2)(A): EPA–HQ–OAR–2014–0828.

[10] EPA is not separately addressing the claims founded in the First Amendment to the Constitution as the APA's petition provision in 5 U.S.C. 553(e) was designed as a specific statutory mechanism by which the public may exercise its First Amendment right to petition the government. *See* U.S. Congress, Senate, Administrative Procedure Act: Legislative History, 79th Cong., 2nd sess., July 26, 1946, S. Doc. 79-248 (Washington: GPO, 1946), at 359.

To the extent that the petitioners seek reconsideration of the 2009 Endangerment Finding under section 307(d)(7)(B) of the CAA, they fail to meet the statutory criteria for such petitions. Section 307(d)(7)(B) strictly limits petitions for reconsideration both in time and scope. It states that:

> Only an objection to a rule or procedure which was raised with reasonable specificity during the period for public comment (including any public hearing) may be raised during judicial review. If the person raising an objection can demonstrate to the Administrator that it was impracticable to raise such objection within such time or if the grounds for such objection arose after the period for public comment (but within the time specified for judicial review) and if such objection is of central relevance to the outcome of the rule, the Administrator shall convene a proceeding for reconsideration of the rule and provide the same procedural rights as would have been afforded had the information been available at the time the rule was proposed. If the Administrator refuses to convene such a proceeding, such person may seek review of such refusal in the United States court of appeals for the appropriate circuit (as provided in subsection (b)). [11]

Thus, EPA is required to convene a reconsideration proceeding under CAA section 307(d)(7)(B) only if a petitioner can demonstrate to EPA: (1)(a) That it was impracticable to raise the objection during the comment period, or (1)(b) that the grounds for such objection arose after the comment period but "within the time specified for judicial review" and (2) that the objection is "of central relevance to the outcome of the rule." Section 307(d)(7)(B) does not mandate that EPA reconsider issues that actually were raised, or could have been raised, during the period for public comment on the proposed 2009 Endangerment Finding. Additionally, grounds for objection that arose more than 60 days after publication of the final rule[12] in the Federal Register are not a proper basis for a petition for reconsideration under section 307(d)(7)(B).[13]

The petitions fail to satisfy the criteria in CAA section 307(d)(7)(B) for mandatory reconsideration proceedings. First, petitioners fail to demonstrate either (a) that it was impracticable to raise their objections during the comment period or (b) that the grounds for such

[11] As explained below, this is a nationally applicable action, or in the alternative, to the extent a court might find this action to be locally or regionally applicable, the Administrator is exercising the complete discretion afforded to him under the CAA to make and publish a finding that it is based on a determination of "nationwide scope or effect" within the meaning of CAA section 307(b)(1). Accordingly, any petition for judicial review of this action must be filed in the United States Court of Appeals for the District of Columbia.

[12] Under CAA section 307(d)(2), the term "rule" as used in section 307(d) of the CAA includes "any action to which [section 307(d)] applies." The 2009 Endangerment Finding was an "action" to which section 307(d) applied. 74 Fed. Reg. at 18889 and n. 4 (April 24, 2009) (citing CAA section 307(d)(1)(K) and (V)) and 74 Fed. Reg. 66496, 66504-66505 (Dec. 15, 2009).

[13] *See Alon Refining Krotz Springs Inc. v. EPA*, 936 F.3d 628, 647-648 (D.C. Cir. 2019) (holding that the "time specified for judicial review" referenced in 307(d)(7)(B) encompasses only the initial 60-day window under section 307(b)(1) and does not extend to subsequent 60-day periods from after-arising grounds).

objection arose after the comment period but "within the time specified for judicial review."[14] Many of the petitioners' claims regarding the scientific basis for the 2009 Endangerment Finding are similar in nature and scope to those previously addressed by EPA in responding to public comments, and petitioners fail to demonstrate that it was impracticable to raise these objections during the period for public comment on the proposed 2009 Endangerment Finding. For example, some petitioners point to post-comment period information to argue that $CO_2$ is not causing climate problems because there is no statistically significant difference between temperatures in 1998 and 2016, although atmospheric concentrations of $CO_2$ differed between these two years by 10%. But numerous commenters raised substantively similar arguments during the comment period on the 2009 Endangerment Finding, "posit[ing] the lack of correlation between global surface and satellite-derived temperature trends and GHG changes calls into question any cause and effect relationship" and specifically "not[ing] global GHG emissions have dramatically risen since 2000 and yet there has not been a concomitant increase in global temperature."[15] Thus, despite the post-comment period information that petitioners now cite to, the "objection" identified in their petitions is substantively similar to the objection raised during the comment period on the 2009 Endangerment Finding – i.e., the claim that an asserted lack of a statistical relationship between temperature data and $CO_2$ concentrations over a selected time frame show that $CO_2$ is not causing climate problems. Petitioners fail to persuasively explain how their objection pertaining to the climate impact of $CO_2$ differs in any material respect from the substantively similar objection raised in 2009, or why they could not raise the same objection in 2009 based on the temperature data and $CO_2$ concentrations available at that time. As another example, some petitioners point to analyses in reports from 2016 and 2017 with the intent of showing that the cycles of ENSO (El Nino Southern Oscillation) events are the key driver behind the observed global warming trend. However, several commenters raised nearly identical objections during the public comment period on the 2009 Endangerment Finding, arguing that "that modes of interannual variation in oceanic temperature and circulation such as the Pacific Decadal Oscillation (PDO), the El Niño-Southern Oscillation (ENSO), and the Atlantic Multidecadal Oscillation (AMO) could be the proximate cause of most or all recent climate changes."[16] Similarly, all of the procedural concerns raised in the petitions, including the claim that EPA should have submitted the proposed 2009 Endangerment Finding to the Science Advisory Board, could have been raised during the public comment period on the proposed 2009 Endangerment Finding.[17] Nor do petitioners argue that that the 2009 Endangerment Finding was

[14] Some of the petitions claim that EPA must convene a proceeding for reconsideration upon a showing that (1) the information arose after the period for public comment on the Endangerment Finding and (2) the objection is of central relevance to the outcome of the rule. (CHECC, p. 2; *see also* FAIR at pp. 3-4). These claims, however, fail to accurately describe the first criterion in CAA 307(d)(7)(B), which requires a showing either that it was impracticable to raise the objection during the comment period *or* that the grounds for such objection arose after the comment period but within the initial window for judicial review under section 307(b)(1). *See Alon*, 936 F.3d at 647-648.

[15] Comment (3-4) in the Response to Comments for the 2009 Endangerment Finding. These issues were thoroughly addressed in the record for the 2009 Endangerment Finding. *See, e.g.,* RTC (3-4).

[16] Comment (3-25) in the Response to Comments for the 2009 Endangerment Finding. These issues were also thoroughly addressed in the record for the 2009 Endangerment Finding. *See, e.g.,* RTC (3-25).

[17] We note that any petition for reconsideration or rulemaking that is predicated on an alleged *procedural* defect in the promulgation of an existing rule is a direct challenge to the original promulgation of that rule, which is time-barred if it falls outside the period in which judicial review of the promulgated rule is

not a logical outgrowth of the proposal.[18] Thus, petitioners fail to establish that it was impracticable to raise these objections at that time.

In addition, the petitioners fail to demonstrate that the grounds for their objections arose after the comment period but "within the time specified for judicial review" within the meaning of CAA section 307(d)(7)(B), i.e., within 60 days after publication of the 2009 Endangerment Finding in the Federal Register. The 60-day period for judicial review of the 2009 Endangerment Finding ended on February 16, 2010. 74 Fed. Reg. 66496 (December 15, 2009). It appears that the post-comment period information cited by the petitioners became available well after that date. For example, the CHECC petition states that the "matters in this Petition could not have been raised during the comment period on the Endangerment Finding because the Research Report on which this Petition principally relies was first published on September 21, 2016, close to seven years *after* the Endangerment Finding."[19] Other petitions similarly rely on documents that became available long after February 16, 2010.[20] These documents fail to constitute grounds arising after the comment period but within the time specified for judicial review and, thus, are not a proper basis for a petition for reconsideration under CAA section 307(d)(7)(B).[21]

Second, petitioners fail to demonstrate that any of their objections "[are] of central relevance to the outcome of the rule." Courts reviewing EPA's bases for denying petitions for mandatory reconsideration have held that an objection is of central relevance to the outcome of the rule only if it provides substantial support for the argument that the regulation should be revised. *See, e.g., Coalition for Responsible Regulation*, 684 F.3d at 125. Based on EPA's conclusion that none of the objections raised in the petitions have merit, as discussed in greater detail below, EPA finds that none of them provide substantial support for the argument that the 2009 Endangerment Finding should be revised and thus none are of central relevance to the outcome of the 2009 Endangerment Finding within the meaning of CAA section 307(d)(7)(B).

In sum, the petitions for reconsideration of the 2009 Endangerment Finding do not meet the statutory criteria for mandatory reconsideration set forth in CAA section 307(d)(7)(B). This conclusion alone supports denial of these petitions, insofar as they seek reconsideration under section 307(d)(7)(B). However, as many of the petitions are framed as petitions for rulemaking, either in the alternative or in the first instance, for purposes of this decision, EPA is also evaluating all of the petitions as APA petitions for rulemaking to reopen or revise the 2009

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permitted. *See American Road & Transportation Builders Ass'n v. EPA*, 588 F.3d 1109, 1112 (D.C. Cir. 2009) (citing *NLRB Union v. FLRA*, 834 F.2d 191, 196 (D.C. Cir. 1987)) and *Alon*, 936 F.3d at 643 (same).

[18] *See Alon*, 936 F.3d at 648 (noting court's prior construction of impracticability prong to cover instances when the final rule was not a logical outgrowth of the proposed rule, which "involve problems during the period for public comment on or petitioning for review of the regulation itself—not problems that arise when circumstances change years or decades later").

[19] CHECC petition, p. 2.

[20] The FAIR petition, for example, states that it is drawing from the Wallace Report, which was first published in September 2016 and supplemented in 2017, and cites work which appears to have become available between in 2013 and 2019. *See* FAIR petition at pp. 2-5. CEI's petition relies on information and documents that appear to have become available between 2013 and 2017. *See* CEI petition at pp. 3-5.

[21] *See Alon*, 936 F.3d at 647-648.

Endangerment Finding.[22] This evaluation provides a consolidated response to all four petitions, however they are styled. For the reasons described herein, we are denying all requests that EPA reconsider or initiate rulemaking to reopen or revise the 2009 Endangerment Finding.

# IV. Background on Continued Advances in Climate Science

To provide additional context for EPA's consideration of the claims raised in the petitions and its reasonable decision not to reopen, revise, or reconsider the 2009 Endangerment Finding based on the petitions, EPA is providing additional background on the continued advances in climate science. Since the 2009 Endangerment Finding, evidence regarding climatic changes has continued to accumulate, with new records being set for several climate indicators such as global average surface temperatures, greenhouse gas concentrations, and sea level rise. Additionally, major scientific assessments continue to be released that strengthen our understanding of the climate system and the impacts that greenhouse gases have on public health and welfare for both current and future generations. These updated observations and projections document the rapid rate of climate change both globally and in the United States. These recent assessments include:

- USGCRP's 2016 Climate and Health Assessment[23] and 2017-2018 Fourth National Climate Assessment[24,25]

[22] Section 4(d) the APA (5 U.S.C. 553(e)) provides that "[e]ach agency shall give an interested person the right to petition for the issuance, amendment, or repeal of a rule."

[23] USGCRP, 2016: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment.* Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp.

[24] USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 470 pp, doi: 10.7930/J0J964J6.

[25] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.

- IPCC's 2018 Global Warming of 1.5°C[26], 2019 Climate Change and Land[27], and 2019 Ocean and Cryosphere in a Changing Climate[28] assessments, as well as the three volumes of the 2021 IPCC Sixth Assessment Report (AR6).[29,30,31]
- The NAS 2016 Attribution of Extreme Weather Events in the Context of Climate Change[32], 2017 Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide[33], and 2019 Climate Change and Ecosystems[34] assessments

[26] IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani,W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)].

[27] IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)].

[28] IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].

[29] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

[30] IPCC, 2022: Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. In Press.

[31] IPCC, 2022: Summary for Policymakers. In: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001

[32] National Academies of Sciences, Engineering, and Medicine. 2016. *Attribution of Extreme Weather Events in the Context of Climate Change*. Washington, DC: The National Academies Press. https://dio.org/10.17226/21852.

[33] National Academies of Sciences, Engineering, and Medicine. 2017. *Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide*. Washington, DC: The National Academies Press. https://doi.org/10.17226/24651.

[34] National Academies of Sciences, Engineering, and Medicine. 2019. *Climate Change and Ecosystems*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25504.

- NOAA's annual State of the Climate reports published by the Bulletin of the American Meteorological Society[35], most recently in August of 2021

These assessments document the recent climatic changes, and attribute these changes to the human-induced buildup of greenhouse gases in our atmosphere. These recent assessments conclude that current atmospheric concentrations of greenhouse gases continue to be at elevated and essentially unprecedented levels, primarily as a result of both historic and current anthropogenic emissions. For example, annual average atmospheric concentrations of one of these greenhouse gases, carbon dioxide, measured at Mauna Loa in Hawai'i and at other sites around the world reached 416 parts per million in 2021, and has continued to rise. Global average temperature has increased by about 1.1 °C (2.0 °F) from the 1850-1900 half-century to the decade of 2011-2020 (IPCC 2021). The years 2014 – 2020 were the seven warmest years in the 1880 – 2020 record, contributing to the warmest decade on record with a decadal temperature of 0.82 °C (1.48 ° F) above the 20th century.[36,37] Global average sea level has risen by about 7-8 inches (about 16-21 cm) from 1900-2015, with almost half of this rise occurring since 1993. The rate of sea level rise over the 20th century was higher than in any other century in at least the last 2,800 years[38]. Arctic sea ice extent continues to decline in all months of the year; the strongest reductions in September (very likely almost a 13% decrease per decade between 1979 and 2018) are unprecedented in at least 1,000 years[39].

Consistent with the robust and extensive scientific record that informed the 2009 Endangerment Finding and the 2010 denial of petitions for reconsideration, these more recent scientific assessments continue to document observed changes in the climate of the planet and of the United States, and present clear support regarding the current and future dangers of climate change. Importantly, these assessments evaluate the findings of numerous individual peer-reviewed studies in order to draw more general and overarching conclusions about the state of science. These assessments synthesize thousands of individual studies and convey the consensus conclusions of the scientific community on what the body of scientific literature tells us. No other source of information on climate change provides such a comprehensive and in-depth analysis across such a large body of scientific studies and adheres to such a high and exacting

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[35] Blunden, J. and T. Boyer, Eds., 2020: "State of the Climate in 2020". Bull. Amer. Meteor. Soc.,102 (8), Si–S475, doi:10.1175/2021BAMSStateoftheClimate.1.

[36] NOAA National Centers for Environmental Information, State of the Climate: Global Climate Report for Annual 2020, published online January 2021, retrieved on February 10, 2021 from https://www.ncdc.noaa.gov/sotc/global/202013.

[37] Blunden, J. and T. Boyer, Eds., 2020: "State of the Climate in 2020". Bull. Amer. Meteor. Soc.,102 (8), Si–S475, doi:10.1175/2021BAMSStateoftheClimate.1.

[38] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.

[39] IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)].

standard of peer review involving multiple rounds of expert, public, and governmental review. Therefore, the robust and comprehensive nature of these recent assessments, along with the strengthened understanding of the climate system that they provide, provide additional context for EPA's consideration of petitioners' claims and support the reasonableness of EPA's decision not to reopen, reconsider or revise the 2009 Endangerment Finding based on the assertions in the petitions.

# V. Arguments Raised by Petitions Relating to the Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act

a. Petition arguments & Agency Responses

CHECC, CEI, and FAIR raised a number of similar issues and relied on many of the same sources. Here we address each of their key arguments.

i. Petitioners' use of Research Reports by Wallace et al.:

CHECC, CEI, and FAIR based the bulk of their arguments on a set of reports by Wallace et al. The first such report cited was "On the Existence of a 'Tropical Hot Spot' & the Validity of EPA's CO2 Endangerment Finding, Abridged Research Report" by Wallace et al. CHECC claims that this original report was peer-reviewed and published on September 21, 2016. (See https://thsresearch.files.wordpress.com/2016/09/ef-cpp-sc-2016-data-ths-paper-ex-sum-090516v2.pdf ("Wallace Report")). Several related reports were also provided – e.g., the supplements submitted by CHECC provided an updated April 2017 version of the Wallace Report (see https://thsresearch.files.wordpress.com/2017/04/ef-data-research-report-second-editionfinal041717-1.pdf), a new report by the same authors from June of 2017, "On the Validity of NOAA, NASA and Hadley CRU Global Average Surface Temperature Data & The Validity of EPA's CO2 Endangerment Finding, Abridged Research Report" (see https:thsresearch.files.wordpress.com/2017/05/ef-gast-data-research-report-062817.pdf), and another report by Wallace et al. from 2018, titled "Comment on 'Examination of space-based bulk atmospheric temperatures used in climate research' by Christy et al." (https://thsresearch.files.wordpress.com/2018/03/ef-data-comment-on-christy-et-al-paper-final-042818v4.pdf).

RESPONSE:

The specific claims raised in the various reports by Wallace et al. are discussed elsewhere in this Denial. Here we note that despite the claims by CHECC that the Wallace et al. reports were peer reviewed, the petitioners have presented no evidence that any of these reports were ever submitted to a peer-reviewed academic journal or any other formal peer review process subject to standard processes to ensure objectivity, independence, transparency, and/or scientific integrity. For example, there is no evidence that the report was assigned to an independent editor who selected independent reviewers with expertise in the appropriate scientific domains who then provided an evaluation of the report to the editor, after which the report would be revised by the authors until the editor is satisfied that credible concerns from the reviewers have been addressed, after which the editor authorizes publication. Generally, peer review is considered a minimum threshold for dissemination of scientific information, though peer-reviewed literature can occasionally be "complemented by other sources (such as gray literature) where appropriate" (NCA, 2018). According to EPA's Peer Review Handbook, "Peer review is conducted to ensure that activities are technically defensible, competently performed, properly documented and consistent with established quality criteria."[40]

However, as noted in the 2009 Endangerment Finding, even peer-reviewed publications are still granted less weight than assessment reports, because, among other reasons, "assessment reports undergo a rigorous and exacting standard of peer review by the expert community, as well as rigorous levels of U.S. government review and acceptance. Individual studies that appear in scientific journals, even if peer reviewed, do not go through as many review stages, nor are they reviewed and comment on by as many scientists" (74 Fed. Reg. 66511).

We have carefully reviewed the content described in the Wallace et al. reports, as well as the petition claims that rely on these reports, and respond to the key findings or assertions in responses below. Consistent with the process used in the development of the 2009 Endangerment Finding, non-peer reviewed reports are afforded less weight when evaluating strength and value of the information they provide. *See* RTC (1-1), (describing EPA's approach to categorizing literature it had received depending on whether or not it was peer-reviewed, and, if so whether it was referenced in the assessment literature, as well as its approach of according less weight to non-peer reviewed literature).

### ii. Petitioners' claims regarding the "three lines of evidence"

CHECC, CEI, and FAIR all claim to have "invalidated each of EPA's three lines of evidence" (CHECC, p. 1). CHECC claims that scientific research since the 2009 Endangerment Finding has invalidated these lines of evidence, and claims that these lines of evidence provide "the basis for the Finding that human GHG emissions endanger human health and welfare" (CHECC, p. 8). In particular, both CHECC and CEI refer to the 2016 Wallace Report in order to state that "the invalidation of the Endangerment Finding is conclusive" (CHECC, p. 1). CEI similarly claims

[40] EPA Peer Review Handbook, 2015, page 20, https://www.epa.gov/sites/default/files/2020-08/documents/epa_peer_review_handbook_4th_edition.pdf, accessed 2/17/22.

that "in the seven years since the Endangerment Finding was issued, new evidence and research has cast serious doubt on the validity of its three lines of evidence" (CEI, p. 2).

RESPONSE:

The Endangerment Finding states (74 Fed. Reg. 66518):

> The attribution of observed climate change to anthropogenic activities is based on multiple lines of evidence. The first line of evidence arises from our basic physical understanding of the effects of changing concentrations of greenhouse gases, natural factors, and other human impacts on the climate system. The second line of evidence arises from indirect, historical estimates of past climate changes that suggest that the changes in global surface temperature over the last several decades are unusual. The third line of evidence arises from the use of computer-based climate models to simulate the likely patterns of response of the climate system to different forcing mechanisms (both natural and anthropogenic).

As stated in this passage, these three "lines of evidence" were used for attributing recent warming to anthropogenic and natural factors in the 2009 Endangerment Finding. None of the petitioners have submitted sufficient evidence rebutting these lines of evidence to support reconsidering or revising the 2009 Endangerment Finding.

While attribution of historical warming to elevated concentrations of greenhouse gases is important, the Agency never characterized these lines of evidence as the "basis" for the 2009 Endangerment Finding. As the Endangerment Finding states (74 Fed. Reg. 66497):

> The Administrator reached her determination by considering both observed and projected effects of greenhouse gases in the atmosphere, their effect on climate, and the public health and welfare risks and impacts associated with such climate change.

Therefore, the Administrator considered the entirety of the evidence regarding both historical and projected climate change, not just the three lines of evidence regarding attribution. Thus, even in the absence of definite historical attribution, there is independent scientific evidence regarding projected climate impacts that also supports the finding of endangerment.

While several petitioners claim that information that has become available since the 2009 Endangerment Finding discredit these three lines of evidence, that claim conflicts with conclusions in the major scientific assessments. The most recent major scientific assessments of the IPCC (the Sixth Assessment Report, or AR6) and the USGCRP (the 4$^{th}$ National Climate Assessment) have only increased their confidence in the attribution of recent warming relative to the assessments prior to 2009. The IPCC AR6 stated in August of 2021 that "It is unequivocal that human influence has warmed the atmosphere, ocean and land" (IPCC AR6 Summary for Policymakers or SPM p. SPM-5). This statement was based on the synthesis of many scientific publications and went through a substantive and rigorous review process. In particular, improvements in climate models, observations of both climate drivers (such as solar variability)

and climate indicators (such as ocean heat), and statistical methods allowed the AR6 assessment to more confidently attribute to human influence not only recent changes in global temperature but also a number of other climate variables. See also section IV above ("Background on Continued Advances in Climate Science") which discusses the assessments that have been released in the past 6 years and how these assessments continue to document observed climate changes and improve projections of future changes.

In addition, it is important to place the Wallace et al. report in context with the information EPA used as the basis for the 2009 Endangerment Finding. As described in the 2009 Endangerment Finding (74 Fed. Reg. at 66510), the Administrator relied on the major assessments of the USGCRP, IPCC, and NRC as the primary scientific and technical basis of her endangerment decision for a number of reasons. Among these reasons is that "the assessments evaluate the findings of numerous individual peer-reviewed studies in order to draw more general and overarching conclusions about the state of science. The USGCRP, IPCC, and NRC assessments synthesize literally thousands of individual studies and convey the consensus conclusions on what the body of scientific literature tells us" (74 Fed. Reg. at 66510). The 2009 Endangerment Finding continues in explaining that: "No other source of information provides such a comprehensive and in-depth analysis across such a large body of scientific studies, adheres to such a high and exacting standard of peer review, and synthesizes the resulting consensus view of a large body of scientific experts across the world. For these reasons, the Administrator is placing primary and significant weight on these assessment reports in making her decision on endangerment" (74 Fed. Reg. at 66511).

Response (1-2) of the Response to Comments document from the 2009 Endangerment Finding further explains that:

> 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*[41].

The Wallace et al. report represents a single study conducted by a limited number of authors, provides no evidence of adequate peer review, and contains technical arguments that do not represent the best available scientific information (as explained in detail below), the Agency has

[41] U.S. EPA (2002). Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity, of Information Disseminated by the Environmental Protection Agency. Washington, DC: U.S. Environmental Protection Agency. EPA/260/R-02/008.

determined that this report does not provide sufficient evidence to support reconsidering or revising the 2009 Endangerment Finding.

iii. Petitioners' argument that warming is fully explained by natural factors

CHECC and CEI state that the results in the 2016 Wallace Report,based on 13 datasets, "clearly demonstrate – 13 times in fact – that once just the ENSO [El Nino/La Nina] impacts on temperature data are accounted for, there is no 'record setting' warming to be concerned about. In fact, there is no ENSO-Adjusted Warming at all" (CHECC, p. 10). FAIR (and CHECC in a supplement) also cite the updated April 2017 version of the Wallace Report, which reiterates the claim that natural factors explain all the observed warming, but adds consideration of another dataset (taking the total to 14 different datasets). FAIR claims that this analysis of 14 temperature records by Wallace is the "most thorough and sophisticated econometric and regression analysis" on that temperature data "ever done by mankind" (FAIR, p. 9) and shows that there is no statistically significant correlation between $CO_2$ concentrations and temperature trends. They further assert that once ENSO is accounted for, there is no warming at all. The 2016 and 2017 Wallace et al. reports used the multivariate ENSO index (MEI), a cumulative MEI metric starting in 1950, and a step function in 1977 for their statistical analysis.

A sixth supplement submitted by CHECC in 2019 provided another report by Wallace et al. from 2018, titled "Comment on 'Examination of space-based bulk atmospheric temperatures used in climate research' by Christy et al.". This report also considers University of Alabama Huntsville (UAH) data, and after using statistical methods to account for the author's estimates of natural influences, similarly finds that there was no residual warming left to be attributed to $CO_2$, though in this case the authors use a cumulate total solar irradiance metric, the MEI (but not cumulative), a step change in 1995, and volcanic activity in order to fit satellite temperatures since 1979.

RESPONSE:

The petitioners cite the Wallace et al. 2016 and 2017 reports' statistical regression of various factors against global temperature trends with the intent of showing that the cycles of ENSO (El Nino Southern Oscillation) events are the key driver behind the observed global warming trend. While such a regression can have some value when performed carefully with a detailed understanding of the climate system, no single statistical technique can substitute for the three key lines of evidence highlighted by the EPA in the 2009 Endangerment Finding in describing the attribution of observed climate change to anthropogenic activities, namely: the basic physical understanding of the climate system; the evidence that recent changes in global surface temperatures are unusual in the historical context; and the use of computer-based climate models grounded in physical understanding to simulate likely patterns of response of the climate system

to both anthropogenic and natural factors. *See* 74 Fed. Reg. 66523. We responded to related arguments in Response 3-25 of the Response to Comments for the 2009 Endangerment Finding:

> Claims that ENSO, [Pacific Decadal Oscillation], [Atlantic Multidecadal Oscillation] and other known modes of internal climate variability can explain all or most of the changes in climate that have occurred over the past century are inconsistent with the assessment literature, and commenters did not provide compelling evidence that the assessment literature has reached fundamentally flawed conclusions.

The Wallace et al. analysis does not present information that would warrant reconsidering or revising EPA's conclusion. In particular, Wallace et al. uses flawed assumptions, such as reliance on a variable called the "cumulative MEI". The MEI is a metric related to ENSO: a positive MEI indicates El Nino conditions, a negative MEI indicates La Nina. The use of the cumulative MEI by Wallace et al. does not incorporate a physical understanding of the climate system: while a positive MEI in a given year is correlated with elevated global air temperatures, Wallace et al. do not take into account the redistribution of heat from the ocean to the atmosphere (Cheng et al. 2019)[42]. By fitting individual econometric equations to each of 13 (or 14) different observed datasets, there is no consideration of thermodynamic laws concerning conservation of energy. This is in contrast to climate models, which "are based on fundamental laws of nature (e.g., energy, mass and momentum conservation)" (IPCC AR5, Chapter 9). The cumulative MEI is somewhat correlated with surface temperature trends from 1950 to present (the time period examined by Wallace et al.), but had Wallace et al. considered an extended dataset that starts in 1871, they would have found that the cumulative MEI does not bear any resemblance to temperature trends from 1871 through 1950.[43] This indicates that the correlation over the period considered by Wallace et al. is spurious. If the cumulative MEI were truly the key driver behind temperature trends, that correlation should be observed in other time periods, not just the one selected for presentation in the Wallace et al. report.

The Wallace et al. 2018 report introduced in the sixth supplement from CHECC introduces a completely different set of parameters (a cumulative solar index rather than the cumulate MEI index, a step change in 1995 instead of 1977, and adding another parameter to explain the warmth of the years 1998 and 2016) without adequately justifying why these parameters are appropriate for this analysis. What this kind of regression approach shows is not that natural factors can explain warming (as the authors do no kind of energy balance or other physically based analysis of the system which would be important to address that issue) but rather that it is not difficult to fit one time series as a function of the sum of multiple other time series when arbitrary coefficients are allowed. Furthermore, while the authors acknowledge that radiative forcings resulting from volcanic eruptions and changes in solar intensity can have influence on the climate system, they do not explain why they believe radiative forcing changes due to changes in greenhouse gas concentrations have no effect. A comprehensive approach should consider all substantial contributions to changes in radiative forcing – e.g., volcanic, solar,

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[42] Cheng et al. Evolution of Ocean Heat Content Related to ENSO, Journal of Climate, 2019, https://doi.org/10.1175/JCLI-D-18-0607.1

[43] The extended MEI datasets is available at https://psl.noaa.gov/enso/mei.ext/. The calculations showing the behavior of the cumulative MEI based on this extended dataset are included in the docket, in the file mei.analysis.3.23.22.xlsx.

greenhouse gases, aerosol emissions (e.g., sulfates, nitrates, and black and organic carbon), snow albedo effects from black carbon deposition, and land-use albedo changes – when attempting to attribute climate changes.

Contrary to the claims of petitioners that these are the most sophisticated econometric analyses ever done, Wallace et al. fail to perform even basic statistical tests. It appears that Wallace et al. just add and subtract parameters in their regression and use R squared and t statistics to determine which fit is better. There are statistical tests that the petitioners have not used that are standard when trying to choose amongst different explanatory equations. For example, the Akaike Information Criteria (Akaike, 1974[44]) is a standard test that is used to avoid overfitting (e.g., adding parameters to a regression can sometimes lead to overfitting, where the R squared or t statistic may improve but models with fewer parameters are actually considered to be superior). Another example is that Wallace et al. use step functions in either 1977 (in their 2016 report) or in 1995 (in their 2018 report) – but they never perform a formal breakpoint detection test, which is a basic statistical requirement for that kind of assumption (e.g., Tomé and Miranda, 2004[45]). These errors would likely have been raised had the Wallace et al. report been subject to an objective, independent, and transparent peer review by scientists with the appropriate expertise.

Because of this incomplete statistical work and poor choices of parameters, the attribution of historical temperature changes by Wallace et al. is substantially inferior to the attribution approaches used by the major scientific assessments, and therefore does not provide grounds for revisiting the 2009 Endangerment Finding.

### iv. Petitioners' arguments regarding the "Tropical Hot Spot"

CHECC argues that climate models have been invalidated by what the petitioner describes as a failure to match the pattern of tropospheric warming, in particular the lack of what the petitioner describes as a "Tropical Hot Spot". CHECC also claims that when EPA discussed the first line of evidence for attribution of historical climate change, "EPA is referring to its 'greenhouse gas fingerprint' or 'tropical hot spot' ('Hot Spot') theory, which is that in the tropics, the upper troposphere is warming faster than the lower troposphere and the lower is warming faster than the surface" (CHECC, p. 8). FAIR similarly claims that an amplification of warming in the troposphere over the tropical latitudes, labeled the "tropical hot spot", "is so fundamental to the theory of anthropogenic global warming that is has been labelled the 'human fingerprint' by which anthropogenic global warming can be identified" (FAIR, p. 8). FAIR also claims that "IPCC's Fourth Assessment Report (AR4) states that the Tropical Hot Spot is 'an integral feature of the physical understanding of the climate's greenhouse warming mechanism.'" (FAIR, p. 9). They claim that this tropical hot spot does not appear in any of the 13 most important

[44] H. Akaike, "A new look at the statistical model identification," in IEEE Transactions on Automatic Control, vol. 19, no. 6, pp. 716-723, December 1974, doi: 10.1109/TAC.1974.1100705.
[45] Tomé and Miranda, Piecewise linear fitting and trend changing points of climate parameters, Geophysical Research Letters, 2004, https://doi.org/10.1029/2003GL019100.

temperature records, whether from satellites or weather balloons or ground-based weather stations.

FAIR also relies on the tropical hot spot to argue that climate models are not solid science. FAIR cites a graph produced by Dr. John Christy that was presented to the US House Committee on Science, Space, and Technology, which shows a divergence in tropical mid-tropospheric temperature trends as assessed by climate models relative to observations from satellites, balloons, and reanalyses. FAIR argues that climate models don't involve falsifiable hypotheses, have diverged from the temperature records (in particular, the petitioner claims that the models do not show that warming has stopped for the past 20 years), and that models don't account for oceanic or solar cycles. FAIR states that these issues invalidate the line of evidence regarding the use of climate models to attribute recent warming to human causes.

RESPONSE:

Regarding the claims concerning a tropical hot spot, the 2009 Endangerment Finding did not refer to the "tropical hot spot" (so called because climate models tend to show higher rates of warming aloft in the tropics as a result of global warming) as part of the first line of evidence for attributing historical climate change to anthropogenic influences. The term "tropical hot spot" never appears in either the 2009 Endangerment Finding nor the 2009 Technical Support Document ("TSD"). There is also no indication that the IPCC ever used the quote FAIR attributed to them regarding the "Tropical Hot Spot" being "an integral feature of the physical understanding of the climate's greenhouse warming mechanism". In the footnote associated with that quote, FAIR references Section 9.2.2.1 of the IPCC, but the word "integral" only appears once in the entirety of Chapter 9, and in that case in reference to its mathematical meaning, and the phrase "tropical hot spot" does not appear at all in Chapter 9, or in the Technical Summary of the entire IPCC AR4 Working Group I report: it seems likely that FAIR was actually quoting the CHECC petition (CHECC, p. 11) rather than the IPCC. In the same footnote, FAIR quotes the IPCC stating that "Greenhouse gas forcing is expected to produce warming in the troposphere" (FAIR p. 9, IPCC AR4 WGI p. 674) as if this supports FAIR's contention that the IPCC found the "tropical hot spot" to be an integral feature, but including a larger fraction of quote makes it clear that the IPCC is contrasting the entire troposphere with the stratosphere, not just the tropical mid-troposphere: "Greenhouse gas forcing is expected to produce warming in the troposphere, cooling in the stratosphere…" (IPCC AR4 WGI p. 674). The IPCC makes this clear in that same chapter when it states that, "Models and observations also both show warming in the lower part of the atmosphere (the troposphere) and cooling higher up in the stratosphere. This is another 'fingerprint' of change that reveals the effect of human influence on the climate." (IPCC AR4 WGI p. 702-3) The "tropical hot spot" was never labeled as a key fingerprint of anthropogenic warming in either the 2009 Endangerment Finding or by the IPCC, contrary to assertions by the petitioners.

While the petitioners mis-characterize how the IPCC and the 2009 Endangerment Finding discuss the "tropical hot spot", the EPA has addressed the issue of model agreement with

observed vertical temperature structure, including in the tropics, in the following places in the record for the 2009 Endangerment Finding: Section 5 of the 2009 TSD; Response 3-7 of the Response to Comments document for the 2009 Endangerment Finding; and Volume 1.2 of the 2010 Response to Petitions document. EPA also rejected the assertion that observed vertical temperature structure in the tropics is inconsistent with modeled trends in the administrative record for the 2009 Endangerment Finding. Response 3-7, after a detailed discussion, states in summary:

> The TSD summarizes this issue and cites the conclusions of the latest major assessments. It states: "an important inconsistency[46] may have been identified in the tropics. In the tropics, most observational data sets show more warming at the surface than in the troposphere, while almost all model simulations have larger warming aloft than at the surface (Karl et al., 2006). Karl et al. (2009) claim that when uncertainties in models and observations are properly accounted for, newer observational data sets are in agreement with climate model results." EPA concludes that the TSD's summary of the current state of the science on tropical tropospheric warming as reflected in the underlying assessment literature is accurate.

Furthermore, as cautioned in the TSD (as well as in the RTC), trends on smaller spatial and shorter temporal scales are more difficult to attribute. With respect to spatial scale, EPA has explained that "as spatial scales considered become smaller, the uncertainty becomes larger because internal climate variability is typically larger than the expected responses to forcing on these scales." (TSD, p. 52 and RTC 4-15). The petitioners' claims about the lack of a "tropical hotspot" are focused on just the mid-tropospheric atmosphere above the tropical latitudes. While this is still an area of ongoing research in terms of better constraining the observational trends in the tropical mid-troposphere and explaining the factors contributing to any differences seen between models and those observations, recent research (Po-Chedley et al., 2021[47]) continues to find that "that multidecadal variability can explain current model–observational differences in the rate of tropical tropospheric warming" consistent with the previous studies cited by EPA on this subject. In addition, two recent papers using different methodologies have suggested that estimations of tropical mid-tropospheric warming based on existing satellite and balloon studies

[46] The full paragraph from the TSD (p. 50), puts the inconsistency for the tropics in context of all the other places on the planet where the anthropogenic signal has been identified: "Not only has an anthropogenic signal been detected for the surface temperatures, but evidence has also accumulated of an anthropogenic influence through the vertical profile of the atmosphere. Fingerprint studies have identified GHG and sulfate aerosol signals in observed surface temperature records, a stratospheric ozone depletion signal in stratospheric temperatures, and the combined effects of these forcing agents in the vertical structure of atmospheric temperature changes (Karl et al., 2006). Karl et al. (2009) state that more recent studies have also found human fingerprints in the patterns of change in Arctic and Antarctic temperatures. However, an important inconsistency may have been identified in the tropics. In the tropics, most observational data sets show more warming at the surface than in the troposphere, while almost all model simulations have larger warming aloft than at the surface (Karl et al., 2006). Karl et al. (2009) state that when uncertainties in models and observations are properly accounted for, newer observational data sets are in agreement with climate model results."

[47] Po-Chedley et al., PNAS 2021, https://www.pnas.org/doi/full/10.1073/pnas.2020962118

may be underestimated: Zou et al. (2021[48]) relies only on satellites in stable orbits since 2002 to estimate the warming rate and finds it greater than previous studies over that time period; Steiner et al. (2020[49]) use a radio occultation methodology starting in 2001 and similarly find a higher rate of warming. Finally, a paper by Santer et al. (2021[50]) compares multiple observational datasets with climate model results and theoretical projections of how warming should change with altitude and finds that the most plausible interpretation is that observations have historically underestimated tropospheric warming.

Given the above, it is unwarranted to claim that climate models are invalid and unreliable due to the possible discrepancy between observations and models for mid-tropospheric tropical temperature trends. In response to previous critiques of climate models, Response to Comments document Volume 4.1 (2009) and the Response to Petitions Volume 1 (2010) cited Karl et al. (2009[51]), which stated that "despite remaining imperfections, the current generation of climate models accurately portrays many important aspects of today's weather patterns and climate. Models are constantly being improved and are routinely tested against many observations of Earth's climate system." (RTC, Response 4-1). This assessment of the value of models despite their imperfections continues to hold true. The 2021 IPCC AR6 Technical Summary determined that models have only improved over time, "Developments in the latest generation CMIP6 climate and Earth system models, including new and better representation of physical, chemical and biological processes, as well as higher resolution, have improved the simulation of the recent mean climate of most large-scale indicators of climate change" (IPCC AR6 TS-16).

Therefore, petitioners' claims regarding tropical mid-tropospheric temperature trends do not provide support for reconsidering or revisiting the 2009 Endangerment Finding.

### v. Petitioners' arguments regarding Climate Sensitivity

The CEI petition claims that balloon and satellite data demonstrate that the atmosphere is far less sensitive to carbon dioxide forcing than predicted by the climate models. The petitioner cites the February 2, 2016 congressional testimony of Dr. John R. Christy, Director of the Earth System Science Center at the University of Alabama, as evidence that "the continued accumulation of both satellite and balloon data has thrown increasing doubt over […] the theory of how climate changes occur, and the associated impact of extra greenhouse gases." The petitioners claim that EPA "largely ignored the two most precise methods for measuring atmospheric temperature,

[48] Zou, Xu, Hao, and Fu, Post-Millennium Atmospheric Temperature Trends Observed From Satellites in Stable Orbits, Geophysical Research Letters, 2021. https://doi.org/10.1029/2021GL093291
[49] Steiner et al., Observed Temperature Changes in the Troposphere and Stratosphere from 1979 to 2018, Journal of Climate, 2020, https://doi.org/10.1175/JCLI-D-19-0998.1.
[50] Santer et al., Using Climate Model Simulations to Constrain Observations, Journal of Climate, 2021, https://doi.org/10.1175/JCLI-D-20-0768.1.
[51] Karl, T., J. Melillo, and T. Peterson (eds.) (2009). Global Climate Change Impacts in the United States. Cambridge University Press, Cambridge, United Kingdom.

satellites and weather balloons" (CEI, p. 4). According to CEI, satellite and balloon data "correlate extremely well with one another despite their being collected through distinctly different methods," (CEI, p. 5) making their results more reliable. Based on Christy's testimony, the petitioner alleges that the climate models are not to be trusted because they do not accurately reflect past atmospheric conditions. FAIR presented a similar claim, stating that William Happer and others have shown that the sensitivity of climate to increases in greenhouse gas concentrations is lower than the IPCC "best estimate" of 3 degrees warming for a doubling of carbon dioxide, with FAIR claiming that Happer "opines the best estimate would be 1 degree C" (FAIR, p. 27), citing a 2019 interview by Happer.

In a related argument, the CEI petition claims that EPA's GHG regulations will have no discernible climate impact. The petitioner claims that "a total elimination of U.S. emissions would have a near zero impact on global climate, […] given the satellite and balloon data findings regarding atmospheric sensitivity" (CEI, p. 5), quoting Christy as calculating an impact in 50 years of eliminating U.S. emissions at "0.05 to 0.08 degrees C" (CEI, p.5).

The petitioner therefore argues that "Given this impossibility of treating the 'illness' supposedly identified by EPA's Finding, the basis for making the Finding in the first place needs reconsideration." (CEI, p.5-6).

RESPONSE:

The latest IPCC assessment stated that "Improved knowledge of climate processes, paleoclimate evidence and the response of the climate system to increasing radiative forcing gives a best estimate of equilibrium climate sensitivity of 3°C" (IPCC AR6, SPM-13), "with a *likely* range of 2.5°C to 4°C". This is comparable to the 2007 IPCC AR4 assessment conclusion of "It is likely to be in the range 2°C to 4.5°C with a best estimate of about 3°C" (IPCC AR4, SPM-12), which was the most recent IPCC assessment at the time the 2009 Endangerment Finding. These assessments use the full range of available information such as paleoclimate evidence, theoretical understanding, ocean heat content, surface temperature records dating back to the 19$^{th}$ century, and other sources of information, in contrast to the approach promoted by the petitioners which is to look only at the single comparison of climate model output with temperatures in a single region of the atmosphere measured by a limited range of methods. In contrast, in the interview by Happer he states that the direct effects of doubling carbon dioxide would be 1 degree C, and then states that the IPCC is incorrect in assuming that there would be any amplification of that warming due to changes in clouds and water vapor. However, Happer presents no evidence supporting his assertion that the IPCC is incorrect: in particular, he shows no reason to expect that in a warmer world, water vapor concentrations would not increase. Therefore, this claim that climate sensitivity is low is not consistent with the findings of the assessment literature, and does not provide support for reopening or reconsidering the 2009 Endangerment Finding.

Regarding the claim that EPA "largely ignored" satellite and radiosonde/balloon temperature data, the 2009 Endangerment Finding and TSD discussed both, as well as the larger context of atmospheric and oceanic measurements. For example, the 2009 Endangerment Finding described

satellite measured temperature trends ("Satellite measurements of the troposphere also indicate warming over the last 30 years at a rate of 0.20 to 0.27 °F (0.11 °C to 0.15 °C) per decade", 74 Fed. Reg. at 66522), and the Endangerment TSD contains a page long discussion of temperatures measured by satellite and radiosondes (TSD, pp. 30-31), and the Response to Comments on the 2009 Endangerment Finding includes many responses to comments about satellite data (e.g., RTC responses 2-41, 2-47, 2-48, 2-49, 2-50, 2-51). Moreover, the claim that satellites are a more precise measure of global temperatures than observations obtained through other means is not supported by the evidence. For example, the above response on the "tropical hot spot" includes a discussion of possible underestimation of tropospheric temperature trends based on satellite observations. Furthermore, it is also relevant that the estimate of warming trends from the satellite data differs by as much as 50% depending on which research group analyzes the data because of choices about how to combine data from different satellites, account for orbital decay, and other challenges - a much larger difference than the difference between estimates of warming based on surface measurements among different research groups. In any case, the 2009 Endangerment Finding drew from assessments which considered the entirety of available data (e.g., surface temperature datasets, satellite data, balloon data, ocean heat data, and indicators such as sea ice retreat and glacial melt), appropriately considered the strengths and weaknesses of each data source, and determined which conclusions could be made based on that entire body of evidence.

EPA also disagrees with the claim that EPA should reconsider the 2009 Endangerment Finding because EPA's GHG regulations will have no discernible climate impact. First, this claim derives from the petitioners' mistaken assertions that climate sensitivity is low, which EPA has addressed earlier in this response. In addition, EPA explained in the 2009 Endangerment Finding that the action was "a stand-alone set of findings regarding endangerment and cause or contribute for greenhouse gases under CAA section 202(a), and does not contain any regulatory requirements." 74 Fed. Reg. at 66515. Accordingly, EPA did not assess the impacts of any future regulation as part of the 2009 Findings. Rather, EPA clarified that future proposed regulations would be evaluated as part the separate proceedings for those actions. *Id.* EPA further explained that the CAA did not require consideration of the eventual impacts of implementing the statute if it made an endangerment finding as part of the endangerment finding itself. *Id.* at 66515-16. Rather, the decision must be based on the science and on the statutory standard of whether the emission of the relevant "air pollutant from any class or classes of new motor vehicles or new motor vehicle engines, … cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health or welfare." CAA section 202(a)(1). Indeed, the Supreme Court had emphasized that EPA could not rely on policy considerations "which have nothing to do with whether greenhouse gas emissions contribute to climate change" as a reason for declining to make the "scientific judgment" contemplated by the CAA. *Massachusetts*, 549 U.S. at 533-34.

Moreover, EPA does not agree that its GHG regulations will have no discernible climate impact. While this question is not relevant to the endangerment inquiry, the Agency considered the impacts of its regulations in establishing emissions standards. In the cause or contribute inquiry for the 2009 Findings, EPA found that motor vehicle emissions contribute to the elevated

greenhouse gas concentrations and, in issuing the first motor vehicle GHG emissions standards, EPA found that the standards "would result in meaningful mitigation of greenhouse gas emissions," including estimations that those standards "would result in a reduction of about 960 million metric tons of $CO_2e$ emissions over the lifetime of the model year 2012-2016 vehicles affected by the new standards." *Coalition for Responsible Regulation*, 684 F.3d at 128. *See also Massachusetts,* 549 U.S. at 525-26 ("While it may be true that regulating motor-vehicle emissions will not by itself *reverse* global warming, it by no means follows that we lack jurisdiction to decide whether EPA has a duty to take steps to *slow* or *reduce* it. … Nor is it dispositive that developing countries such as China and India are poised to increase greenhouse gas emissions substantially over the next century: A reduction in domestic emissions would slow the pace of global emissions increases, no matter what happens elsewhere.").

Accordingly, EPA is not reopening or reconsidering the 2009 Endangerment Finding based on these claims.

vi. Petitioners' arguments regarding tampering with the temperature datasets

CHECC claims that Wallace et al. has uncovered evidence of temperature data tampering and manipulation. The second supplement, submitted by the petitioner in July of 2017, provided a new Wallace Report from June of 2017, "On the Validity of NOAA, NASA and Hadley CRU Global Average Surface Temperature Data & The Validity of EPA's CO2 Endangerment Finding, Abridged Research Report" (see https:thsresearch.files.wordpress.com/2017/05/ef-gast-data-research-report-062817.pdf). The petitioner claims that this new report by Wallace et al., which set out to analyze the credibility of the global average surface temperature datasets from NOAA, NASA and Hadley CRU, demonstrates that these datasets have been adjusted by removing cyclical temperature patterns and are therefore invalid. The petitioner quotes Wallace et al. as stating, "It was found that each new version of GAST has nearly always exhibited a steeper warming trend over its entire history."

RESPONSE:

The accusation by petitioners that NOAA, NASA, and the Hadley Climatic Research Unit all make inappropriate adjustments is very similar to accusations made in the 2010 Petitions for Reconsideration, which were fully responded to by the Agency at that time. For example, CEI claimed in 2010 that every adjustment "resulted in temperature trends that appeared to increase faster than they did in reality." (RTP Comment 1-64). However, even the source that CEI relied upon at the time (D'Aleo and Watts, 2010) stated the source upon which they in turn had relied "showed that 20% of the historical record was modified 16 times in the 2½ years ending in 2007. 1998 and 1934 ping pong regularly between first and second warmest year" and "note[d] that the overall trend in changes between now and Sep. 24, 2005 is very close to zero" (RTP Response 1-64), which is not consistent with the claim that every adjustment leads to an increase in trends. Moreover, from 2010-2012 a 4$^{th}$ independent organization, the Berkeley Earth (berkeleyearth.org), also analyzed the surface temperature data specifically to address concerns that had been raised such as "potential biases from data selection, data adjustment, poor station

quality, and the urban heat island effect" (https://berkeleyearth.org/methodology/) and the estimates of historical temperature produced by this group were "quite similar to records from Hadley's HadCRUT4, NASA's GISTEMP, NOAA's GlobalTemp, and Cowtan and Way" (Rohde and Hausfather, 2020[52]). Further, all of the adjustment procedures are documented in the peer reviewed literature. In fact, as discussed in the Response to Petitions (RTP, Volume 1, pp. 101-102), Clear Climate Code was able to replicate the NASA GISTEMP code in python, and made that code publicly available. The original GISTEMP code itself is also available (https://data.giss.nasa.gov/gistemp/sources_v4/). There is no indication that the petitioners have reviewed the publicly available code and the petitions have not identified any evidence of inappropriate adjustment techniques in that code. Nor have the petitioners or Wallace referenced any of the many publications which describe changes and improvements between one dataset version and the next (e.g. Morice et al. 2021[53]).

Meanwhile, the Wallace report accusations regarding the removal of cyclical temperature pattern appears to rely solely on isolating a few individual regions – several cities and states in the US, one city in Greenland, and one analysis of the Arctic region – and then asserting (without using any statistical methodologies) that a cyclical pattern exists in the temperature records from those regions. The Wallace report then claims that there should therefore be a similar cyclical pattern in the global temperature dataset without discussing the fact that the regions analyzed comprise a very small percent of the total global surface area. Again, neither Wallace et al. nor the petitioners reference either the publicly available code or any of the many papers describing how data are processed in order to generate global surface temperature trends, which is a basic step to take before making accusations of improper data tampering.

These critiques from a report that has not been peer reviewed do not provide credible evidence that four major climate science organizations with an extensive record of peer-reviewed literature are all independently and inappropriately adjusting their surface temperature datasets, nor do these critiques identify any errors in the actual code or adjustment procedures. Therefore, this claim does not provide support for reopening or reconsidering the 2009 Endangerment Finding.

### vii. Petitioners' arguments regarding "alarmist claims"

CHECC: A fifth supplement was submitted by the petitioner in February of 2018. This supplement included 10 brief rebuttals to what the petitioner characterizes as "typical climate alarmists' claims" (CHECC, fifth supplement, p. 4). The petitioner further states that this information "invalidates oft-repeated alarmist claims that human emissions of GHGs will cause calamitous changes in other state variables of the climate system such as sea level rise, ocean acidification, and extreme events." (CHECC, fifth supplement, p. 2)

[52] Rohde, R. A., & Hausfather, Z. (2020). The Berkeley Earth land/ocean temperature record. Earth System Science Data Discussions. https://doi.org/10.5194/essd-2019-259

[53] Morice et al., An Updated Assessment of Near-Surface Temperature Change From 1850: The HadCRUT5 Data Set, 2020, https://doi.org/10.1029/2019JD032361

RESPONSE:

CHECC does not connect these claims to language in the 2009 Endangerment Finding, or, indeed, in any of the scientific assessment literature that was cited in that Finding. For example, their third purported "alarmist claim" is that "global warming is causing more and stronger tornadoes" (CHECC, fifth supplement, p. 7). However, the Endangerment Finding does not mention tornadoes, and the three mentions of tornadoes in the TSD are: that there are "significant uncertainties in long-term trends"; quoting Kunkel et al. (2008) to say that "[t]here is no evidence for a change in the severity of tornadoes…"; and citing the IPCC to state that there is "insufficient evidence to determine whether trends exist in small-scale phenomena such as thunderstorms, tornadoes, hail, lightning, and dust-storms" (TSD, p. 44-46). Accordingly, this list of claims is not relevant to the 2009 Endangerment Finding and does provide any support for reconsidering or revising the Finding.

viii. Petitioners' claims regarding future cooling of the climate

CHECC and FAIR both made claims that the planet is about to cool. CHECC in their sixth supplement stated that "based on a well-known solar activity forecast (Abdussamatov 2015) and specific assumptions on the other natural explanatory variables (i.e., volcanic and oceanic/ENSO activity), Wallace 2018 also provides a long-term forecast that UAH TLT (i.e., lower tropospheric) temperatures are very likely to exhibit a declining trend over the period through 2026 at the least" (CHECC, sixth supplement, p. 2). FAIR made a similar argument that cooling is imminent, citing a number of news articles and blog posts from 2013 that recent trends in sunspots indicate an imminent global cooling (for example, from the Voice of Russia, that "According to scientists from the Pulkovo Observatory in St. Petersburg, solar activity is waning, so the average yearly temperature will begin to decline as well", FAIR p. 14).

RESPONSE:

The claims from CHECC and FAIR that temperatures are about to decline are not scientifically supported. Not only has there been no evidence yet of a temperature decline after 2016 (2020 was effectively tied with 2016 for the hottest year on record[54], and 2021 was tied with 2018 as

[54] See, e.g., https://www.noaa.gov/news/2020-was-earth-s-2nd-hottest-year-just-behind-2016 (noting conclusion from NOAA analysis that the "average land and ocean surface temperature across the globe in 2020 was 1.76 degrees F (0.98 of a degree C) above average — just 0.04 of a degree F (0.02 of a degree C) cooler than the 2016 record" and that the "world's seven-warmest years have all occurred since 2014")

the sixth warmest year on record[55]), but this prediction of future cooling is one that EPA has responded to previously. For example, in response 3-26 of the 2009 Endangerment Finding RTC, EPA stated:

> The predictions of imminent cooling based on cycle analysis are not consistent with the assessment literature. These studies do not present any evidence for any negative external radiative forcings that could be of the magnitude of the positive forcing from increases in GHG concentrations. IPCC has shown that it is possible to explain previous temperature trends based on reconstructions of historical solar, volcanic, GHG, and orbital forcings, but the methods used to explain the previous changes cannot explain recent warming without the contribution of changes in GHG concentrations due to anthropogenic emissions. Specifically, historical reconstructions of solar and volcanic forcing have been used as inputs to model simulations; these simulations explain much of the last 1,000 years of temperature change, but the recent warming cannot be explained by the same natural forces that explained previous temperature changes (Jansen et al., 2007). Similarly, when forced by changes in solar forcing due to orbital parameters, coupled climate models and Earth System Models of Intermediate Complexity were both able to capture reconstructructed [sic] regional temperature and precipitation changes (Jansen et al., 2007).

Like all these previous claims, the new claim from Wallace (2018) suffers serious flaws. First, as discussed above in the response to the claims that Wallace et al. could explain historical warming based on natural factors, this regression analysis by Wallace et al. is based on incorrect assumptions. Second, the solar activity forecast by Abdussamatov[56] is not based on sound science: it appears that the forecast is based on extrapolating a short-term trend without good physical basis. This forecast projected a decrease of 2 W/m$^2$ between the 1980s and 2020, with most of the decline happening between 2015 and 2020. In contrast, the IPCC AR6 assessment found that "TSI [total solar irradiance] did not change significantly between 1986 and 2019" (IPCC AR6 p. 2-13, 2021). Therefore, this use of an incorrect methodology applied to incorrect solar forecasts, and which is inconsistent with the available observational data, does not provide support for reopening or reconsidering the 2009 Endangerment Finding.

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(last accessed Dec. 17, 2021). See also https://www.nasa.gov/press-release/2020-tied-for-warmest-year-on-record-nasa-analysis-shows (noting conclusion from an separate analysis by NASA that "Earth's global average surface temperature in 2020 tied with 2016 as the warmest year on record" and that the "last seven years have been the warmest seven years on record, typifying the ongoing and dramatic warming trend") (last accessed Dec. 17, 2021).

[55] See, e.g., https://www.nasa.gov/press-release/2021-tied-for-6th-warmest-year-in-continued-trend-nasa-analysis-shows (last accessed March 11th, 2022).

[56] Abdussamatov, H, Current Long-term negative average annual energy balance of the earth leads to the new little ice age, Thermal Science, 2015, DOI:10.2298/TSCI140902018A

ix. Petitioners' claims that the social cost of carbon dioxide should be negative

In a seventh supplement submitted in 2021, CHECC argued that the social cost of $CO_2$ should be negative because global average surface temperatures are fabricated, climate models are flawed, and the equilibrium climate sensitivity to $CO_2$ is zero. The petitioner claims that if there is no reliable surface temperature data set, if climate models are flawed (compared to the statistical analyses of Wallace et al.), and if climate sensitivity is zero (because there's no empirically validated theory showing that $CO_2$ has influenced temperature), then EPA's conclusions that $CO_2$ causes any harms such as sea level rise, more intense storms, or any following causal argument are all wrong, and that $CO_2$ is actually a beneficial gas. This supplement further argues that the social cost of each trace GHG other than $CO_2$ should also be negative and that these are also beneficial gases.

RESPONSE:

Importantly, the social cost of carbon played no role in the 2009 Endangerment Finding, so arguments about the social cost of carbon are not relevant to the 2009 Endangerment Finding. EPA's conclusions in the 2009 Endangerment Finding about the harms from elevated concentrations of greenhouse gases were not based on any consideration of the social cost of carbon, but rather on the Administrator's consideration of the full scientific record before her, including information on the observed and projected effects of greenhouse gases in the atmosphere, their effect on climate, and the public health and welfare risks and impacts associated with such climate change. *See, e.g.*, 74 Fed. Reg. 66497. As described in section IV above ("Background on Continued Advances in Climate Science") those conclusions have only been strengthened by later major scientific assessments. Similarly, the social cost of the other well-mixed greenhouse gases included in the definition of the air pollution and air pollutant evaluated in the 2009 Endangerment Finding had no impact on the inclusion of those gases in the Findings. *See, e.g.,* 74 Fed. Reg. 66516-66523 (explaining the rationale for including the six well-mixed gases in the air pollution addressed in the 2009 Endangerment Finding based on their common attributes); *see also id.* at 66536-66537 (explaining the rationale for including the six well-mixed gases in the air pollutant addressed in the cause or contribute portion of the 2009 Finding). However, even if the social cost of carbon were relevant to the 2009 Endangerment Finding—which it is not— petitioners' individual arguments about the reliability of global surface temperature data (including in light of the data adjustment procedures), climate models, and climate sensitivity are not well-founded, as explained above.

x. Petitioners' claims that the carbon dioxide is beneficial

Similarly, FAIR argues that *Massachusetts v. EPA* was wrongly decided by the U.S. Supreme Court because carbon dioxide cannot be considered "pollution." FAIR justifies this claim by stating that carbon dioxide is "a naturally occurring gas that makes up only .04 percent, or 400 parts per million, of the atmosphere. Only about 3 percent of that tiny amount is generated by human activities" (FAIR, p. 22). FAIR further claims that "[w]ithout Carbon Dioxide in the

atmosphere, plants would die" and that "the historical increase in the atmosphere's CO2 concentration has stimulated vegetative and agricultural productivity" leading to benefits for humans (FAIR, pp. 22-23). FAIR also argues that "the effect of $C0_2$ [sic] in causing warming declines logarithmically asymptotically to zero, as $CO_2$ concentration increases" (FAIR, p. 25). FAIR also argues that $CO_2$ has been at much higher concentrations in the geologic past, that the 300 ppm preindustrial level of $CO_2$ was near the 200 to 250 ppm minimum necessary for plant survival, and that changes in $CO_2$ precede changes in temperature. CEI also claims that atmospheric carbon levels have been 15 times greater in the past, "without known adverse effects."

RESPONSE:

FAIR's assertions are based on several incorrect assumptions. First, although issues related to beneficial effects and historic concentrations of carbon dioxide were addressed at length in the record for the 2009 Endangerment Finding, FAIR's assertions misunderstand the core bases of the 2009 Endangerment Finding, for example by failing to recognize that the 2009 Endangerment Finding is directed at "elevated concentrations" of GHGs in the atmosphere. *See e.g.* 74 Fed. Reg. 66497; *see also, e.g.,* RTC 9-7 and RTP 3-8 (addressing similar arguments). In addition, the IPCC AR6 assessment determined that it is "unequivocal that the increase of CO2, CH4, and N2O in the atmosphere over the industrial era is the result of human activities" (IPCC AR6, 2021): the increase due to humans for CO2 is 47% (IPCC AR6, 2021), not the 3% claimed by FAIR. While FAIR is correct that the relationship of CO2 concentrations and radiative forcing (or the "effect of CO2 in causing warming") is logarithmic, FAIR is incorrect that this implies an asymptote: in fact, a logarithmic relationship implies a constant increase for every doubling of the concentration of the gas, without any asymptote[57]. Whether CO2 was higher in the geologic past (e.g., more than 2 million years ago) is irrelevant to the question of endangerment, as the climate of the planet was dramatically different in that era, and humans had not yet evolved. Further, this argument was addressed in the Response to Comments for the 2009 Endangerment Finding: "Although GHG concentrations in the distant past have substantially exceeded current levels, the existence of high GHG concentrations in the very distant past does not demonstrate that there are not negative consequences of high concentrations in the present, as addressed in the assessment literature" (RTC 3-54); *see also* RTC 9-7 (noting that "while CO2 concentrations may be low compared to the average of the past billion years, EPA finds it is much more relevant that CO2 concentrations are very likely higher than anything seen in the past million years."). Ice cores show that CO2 concentrations were as low as 180 ppm during glacial maxima several times over the past million years (IPCC AR5 Chapter 5, p. 391), and plants survived those periods: given today's concentrations of 416 ppm, there is no concern that CO2 concentrations could drop below the minimum necessary for plant survival.

[57] This is part of the basic definition of a logarithm. E.g., "Does the graph of a general logarithmic function have a horizontal asymptote? … No. A horizontal asymptote would suggest a limit on the range, and the range of any logarithmic function in general form is all real numbers" from https://opentextbc.ca/precalculusopenstax/chapter/graphs-of-logarithmic-functions/.

In addition, we note that where relevant EPA reasonably considered the potential beneficial impacts of GHGs in the 2009 Endangerment Finding and the supporting record, as well as the associated risks and related uncertainties. *See, e.g.,* 74 Fed. Reg. 66524 (describing EPA's consideration of both beneficial and adverse effects). To provide just one example, EPA's discussion of food production and agriculture acknowledged evidence that increased CO2 and temperature would likely cause the life cycle of grain and oilseed crops to progress more rapidly. *See id.* at 66531. However, EPA also noted that such beneficial influences needed to be considered in light of various other effects, such as potential effects on pest and weed growth and disease. *Id.* In addition, EPA noted that "higher temperature increases, changing precipitation patterns and variability, and any increases in ground-level ozone induced by higher temperatures, can work to counteract any direct stimulatory carbon dioxide effect, as well as lead to their own adverse impacts." *Id.* Taking both near- and long-term trends into account, the Administrator concluded that "the body of evidence points towards increasing risk of net adverse impacts on U.S. food production and agriculture, with the potential for significant disruptions and crop failure in the future." *Id.* at 66531-66532. This type of nuanced consideration, based on an extensive and well-support scientific record, stands in stark contrast to the petitions' oversimplified assertions. Moreover, impacts on ecosystems and agriculture are only a small part of the total impact of elevated GHG concentrations, and the Administrator considered the entirety of the impacts of GHGs when making her conclusions.

Furthermore, EPA does not agree with the claim that *Massachusetts v. EPA* was wrongly decided because greenhouse gases should not be considered air pollution. To the contrary, as described in the 2009 Endangerment Finding, EPA interprets the definition of the term "air pollutant" in section 302(g) of the CAA to include greenhouse gases. *See, e.g.,* 74 Fed. Reg. at 66510. EPA also fully explained in the 2009 Endangerment Finding why it considers the six well-mixed greenhouse gases air pollution, as that term is used in section 202(a) of the CAA. *See, e.g.,* 74 Fed. Reg. at 66516-66517 (summarizing reasons for defining the air pollution addressed by the 2009 Endangerment Finding as the combination of six well-mixed greenhouse gases); *see also* 74 Fed. Reg. at 66536-66537 (describing rationale for defining the air pollutant as the combination of the same six well-mixed gases).

For these reasons, the arguments by petitioners that CO2 is harmless—or even net beneficial—do not counter the extensive and well-supported record that supported the 2009 Endangerment Finding and the later evidence that has only strengthened those conclusions. Accordingly, EPA concludes that none of these claims warrant reopening or reconsidering the 2009 Endangerment Finding.

xi. Petitioners' claim that a lack of warming between 1998 and 2016 is evidence that CO2 has no impact

The CEI petition claims that there has been no statistically significant atmospheric warming despite a continued increase in carbon dioxide levels. The petitioner asserts that the two warmest years on record, and their corresponding atmospheric carbon dioxide concentrations, in parts per million (ppm), are 1998 (367.13 ppm) and 2016 (404.48 ppm). They argue that while the difference in atmospheric carbon dioxide concentrations between these two years was 10%, the difference in temperature was only 0.02 degrees Celsius. They calculate that this temperature

difference is not statistically significant at the 95% confidence level. CEI states that the 18 year period between 1998 and 2016 is twice as long as the seven to ten years that were discussed in the 2009 Endangerment Finding as not showing a strong trend in temperatures, and that therefore this period cannot be dismissed as a "limited analysis". The petition further surmises that this lack of a strong warming trend over that period of time "draws into serious question EPA's contention that we have an adequate 'physical understanding of the effects of changing concentrations of GHGs … on the climate system.'"

FAIR made a similar claim that satellite data showed no warming between February of 1997 and October of 2015. The petitioners state that this lack of warming disproves the line of evidence regarding the unusual nature of the warming over the last several decades.

RESPONSE:

The petitioners' argument that the climatic effect of $CO_2$ is disproved by the lack of a statistically significant difference between the temperatures in 1998 and 2016 is both incorrect and a rehash of prior arguments that were already addressed. Similar logic was already addressed in the 2009 Response to Comments document. Furthermore, the statistical analysis from the petitioners lacks rigor, and does not consider the entirety of the data. Moreover, the additional years of temperature observations after the release of the 2009 Endangerment Finding support the Finding rather than undermine it. Therefore, this argument from the petitioners is not grounds to reopen or reconsider the 2009 Endangerment Finding.

First, Response 3-4 from the 2009 Response to Comments examines the argument that $CO_2$ and temperature are not linked if temperatures do not rise over a short period where $CO_2$ emissions are rising, stating that "Climate over the 21$^{st}$ century can and likely will produce periods of a decade or two where the globally averaged surface air temperature shows no trend or even slight cooling in the presence of longer-term warming." None of the data that the petitioners present is inconsistent with the conclusions from this response.

Second, by focusing only on whether 1998 and 2016 are not distinguishable statistically, or whether the trend from 1998 to 2016 is statistically significant, the petitioners are not properly considering how the variability inherent in climate trends interacts with statistical significance tests. Because there is year to year variability due to factors such as ENSO events, the uncertainty in trend calculations for short time periods can be large. This is particularly true for satellite data, as tropospheric temperatures are more sensitive to ENSO events than surface temperatures. Therefore, a lack of statistical significance is not meaningful for short term trends in this context. Similarly, simply looking only at whether there is a statistically significant difference in temperature between two single years is not an adequate basis for determining the trend over the intervening period, as it does not consider any information for the intervening years.

This can be seen when temperature trends at the time of the 2009 Endangerment Finding are compared to temperature trends including recent data: the 2009 TSD cited temperature trends from 1980 to 2008 of 0.16-0.17 degrees C/decade (TSD, p. 29, for the NOAA, NASA, and HadCRUT temperature datasets). The IPCC AR6 has updated temperature trends from 1980 through 2020: these trends range from 0.18-0.20 degrees C/decade (IPCC AR6, p. 2-46, for seven different temperature datasets). For satellite temperatures measuring tropospheric temperatures, the 2009 TSD cited estimates for temperature trends from 1979 to 2008 ranging from 0.12 to 0.19 degrees C/decade (TSD, p. 30), and the IPCC now estimates trends for 1980 to 2019 of 0.13 to 0.23 degrees C/decade (IPCC AR6, p. 2-49, six lower troposphere datasets). Therefore, the most recent data indicates that the rate of warming is increasing, contrary to the petitioners' arguments.

In addition, this issue was addressed by the Fourth National Climate Assessment (NCA4, 2018), which noted that while the rate of surface temperature warming may have slowed temporarily in the early years of the 21st century, ocean heat content continued to rise unabated.[58] Because the oceans have a much larger thermal mass than the atmosphere, small fluctuations in ocean heat due to changes in currents (such as ENSO) can lead to larger fluctuations in atmospheric temperature, such that a reduction in atmospheric warming may not "represent a slowdown in warming of the climate system but rather is an energy redistribution within the oceans" (Yan et al. 2016[59]). The continued increase in ocean heat content over the period after 1998 indicates that this is the case: while atmospheric temperatures may have fluctuated, there was no slowdown in total warming of the Earth system. The NCA4 went on to state that:

> For short periods of time, from a few years to a decade or so, the increase in global temperature can be temporarily slowed or even reversed by natural variability (see Box 2.1). Over the past decade, such a slowdown led to numerous assertions that global warming had stopped. No temperature records, however, show that long-term global warming has ceased or even substantially slowed over the past decade (NCA4, p. 76)

This is another example of petitioners cherry-picking narrow temporal windows from specific long-term datasets to attempt to support their assertions, without accounting for more complete information (longer time periods, larger geographic regions, and more temperature metrics). Therefore, this claim does not provide support for reopening or reconsidering the 2009 Endangerment Finding.

### xii. Petitioners' claim that recent warming is far from unusual

[58] Wuebbles, D. J., D. R. Easterling, K. Hayhoe, T. Knutson, R. E. Kopp, J. P. Kossin, K. E. Kunkel, A. N. LeGrande, C. Mears, W. V. Sweet, P. C. Taylor, R. S. Vose, and M. F. Wehner, 2017: Our Globally Changing Climate. Climate Science Special Report: Fourth National Climate Assessment, Volume I. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds., U.S. Global Change Research Program, Washington, DC, USA, 35–72. doi:10.7930/J08S4N35. Box 1.1.
[59] Yan, X.-H. et al. The global warming hiatus: slowdown or redistribution? Earths Futur. 4, 472–482 (2016)

The CEI petition claims that recent changes in global temperature are far from unusual. The petitioner states that a "more recent, comprehensive review of the scientific literature" than the 2009 Endangerment Finding comes to the conclusion that recent fluctuations in temperature are "within the bounds of natural variability."

RESPONSE:

EPA addressed several claims debating whether recent temperatures are unusual in the 2010 Response to Petitions (Vol. 1, p. 8):

> Placing the paleoclimate work into the broader climate science context, the TSD cites the U.S. Global Change Research Program (USGCRP) statement that "The second line of evidence arises from indirect, historical estimates of past climate changes that suggest that the changes in global surface temperature over the last several decades are unusual (Karl et al, 2009)." The phrase in Karl et al. regarding "indirect historical estimates" refers to the paleoclimate reconstructions based on proxies. Following Karl's statement, the unusual nature of the current warming in the context of the past 1,000 years contributes to one of the lines of evidence supporting the attribution of current warming to human activities. Note that "unusual" does not mean unprecedented, and past warming must be considered in the light of what we know about past climatic forcings such as solar and volcanic activity. Additionally, in the IPCC chapter on attribution, Hegerl et al. (2007) states that "[a]nalyses of palaeoclimate data have increased confidence in the role of external influences on climate." Hegerl et al. are stating that paleoclimate information improves our understanding of the difference between how the climate responds to external changes, such as changes in solar radiation, orbital characteristics, GHG concentrations, or atmospheric loadings of aerosols (such as from volcanic eruptions), compared to internal changes such as el Niño events.

The EPA also responded to numerous similar comments regarding temperatures over the past 1000 years: see Reponses 2-62 through 2-69 of the 2009 Response to Comments document. In the 2009 Endangerment Finding itself, EPA responded to these comments (74 Fed. Reg. 66523):

> A number of commenters argue that the warmth of the late 20th century is not unusual relative to the past 1,000 years. They maintain temperatures were comparably warm during the Medieval Warm Period (MWP) centered around 1000 A.D. We agree there was a Medieval Warm Period in many regions but find the evidence is insufficient to assess whether it was globally coherent. Our review of the available evidence suggests that Northern Hemisphere temperatures in the MWP were probably between 0.1 °C and 0.2 °C below the 1961–1990 mean and significantly below the level shown by instrumental data after 1980. However, we note significant uncertainty in the temperature record prior to 1600 A.D.

Improved paleoclimate data has only increased the confidence of scientists in the unusual nature of the current climate, with the IPCC AR6 assessment finding that global surface temperature has increased faster since 1970 than in any other 50-year period over at least the last 2000 years (*high confidence*). Temperatures during the most recent decade (2011–2020) exceed those of the

most recent multi-century warm period, around 6500 years ago [0.2°C to 1°C relative to 1850–1900] (*medium confidence*). Prior to that, the next most recent warm period was about 125,000 years ago when the multi-century temperature [0.5°C to 1.5°C relative to 1850–1900] overlaps the observations of the most recent decade (*medium confidence*).

Separately, the CEI argument that recent temperature changes are within the bounds of natural variability has been addressed in the 2009 Response to Comments (Response 3-6):

> As stated in an earlier response, elevated GHGs are not the only determinant of changes in temperature at the surface and in the troposphere, though most of the observed increase in global temperatures since the mid-20th century has been attributed to the observed increase in GHG concentrations. Elevated GHGs act in addition to aerosols, land albedo changes, volcanoes, solar changes, and internal variability. A review of the literature shows that there are scientifically compelling explanations for the pattern of global temperature change over the past century. The information on attribution assessed by the IPCC, USGCRP, and CCSP, as summarized in the TSD, is consistent with the observed temperature record and therefore does not call into question the evidence supporting attribution of most of the observed warming since 1950 to increased GHG concentrations.

The response also quoted the IPCC assessment (Hegerl et al., 2007) as stating that, "many observed changes in surface and free atmospheric temperature, ocean temperature, and sea ice extent, and some large-scale changes in the atmospheric circulation over the 20th century are distinct from internal variability and consistent with the expected response to anthropogenic forcing." Effectively, the timing and patterns of the recent climatic changes, and lack of observed natural drivers, eliminate the possibility that natural variability has significantly contributed. More recent assessments have only strengthened the conclusion that recent warming can be attributed to human influence (e.g., the IPCC AR6 SPM at page SPM-6 stated, "It is very likely that well-mixed GHGs were the main driver of tropospheric warming since 1979").

Therefore, the science regarding the unusual nature of recent temperature change has only grown stronger since the 2009 Endangerment Finding, and the argument by CEI that recent temperature change is not unusual does not support reconsidering or reopening the Endangerment Finding.

### xiii. Petitioners' objection that EPA should have submitted the 2009 Endangerment Finding to the SAB

TPP states that EPA should reconsider the 2009 Endangerment Finding because EPA failed to comply with a nondiscretionary statutory mandate in 42 U.S.C. §4365(c)(1) by failing to submit the 2009 Endangerment Finding to the EPA Scientific Advisory Board (SAB) for peer review. (TPP, p. 13). TPP argues that EPA was required to submit the 2009 Endangerment Finding to the SAB because it falls within the definition of a "rule" in the Administrative Procedure Act, citing 5 U.S.C. §551(4), and thus is a "regulation" subject to the SAB submittal requirement in 42 U.S.C. §4365(c)(1). TPP further asserts that EPA triggered the SAB submittal requirement by providing the 2009 Endangerment Finding to the Office of Management and Budget (OMB), pursuant to Executive Order (E.O.) 12866. TPP argues that this failure to submit was not

harmless error, pointing to adverse economic impacts the 2009 Endangerment Finding allegedly had. TPP further contends that if EPA had made the 2009 Endangerment Finding available to the SAB, the SAB would have identified various gaps that TPP asserts were in the 2009 Endangerment Finding, such as EPA's alleged failure to address whether the Finding or any of the related GHG rules would remove dangers to human health or welfare, influenced EPA's evaluation of the science, and the review would have led to "significant change" in the 2009 Endangerment Finding. (TPP, pp. 4-5, 26-28, 30-31).[60]

TPP states that "the SAB submittal requirement was raised during the public comment period on the proposed Endangerment Finding." (TPP, p. 8). Additionally, while acknowledging the D.C. Circuit's decision in *Coalition for Responsible Regulation, Inc. v. EPA*, 684 F.3d 102 (D.C. Cir. 2012), which addressed, *inter alia*, challenges to the 2009 Endangerment Finding based on EPA's alleged failure to submit it to the SAB, TPP argues that the court's decision does not constrain EPA from reconsidering the Finding. (TPP, p. 18-28). Finally, TPP argues that EPA has inherent discretion to reconsider the 2009 Endangerment Finding, that EPA "may determine as a matter of policy that the [2009 Endangerment Finding] should have been submitted to [SAB]," and that EPA's failure to do so "triggers reconsideration of the [2009 Endangerment Finding]." (TPP, pp. 28-29).

RESPONSE

Petitioner's assertions regarding submission of the 2009 Endangerment Finding to the SAB rehash a procedural argument that was raised during judicial review of the 2009 Endangerment Finding and resolved in EPA's favor. The D.C. Circuit upheld the 2009 Endangerment Finding after considering claims that EPA had failed to satisfy the statutory mandate in 42 U.S.C. 4365(c)(1) to "make available" to the SAB "any proposed criteria document, standard, limitation, or regulation under the Clean Air Act" at the time it provides the same "to any other Federal agency for formal review and comment." *Coalition for Responsible Regulation*, 684 F.3d at 124. The court further held that "even if EPA violated its mandate by failing to submit the Endangerment Finding to the SAB, … Petitioners have not shown that this error was of such central relevance to the rule that there is a substantial likelihood that the rule would have been significantly changed if such errors had not been made." *Id.* (citing standard in CAA section 307(d)(8) for challenges to procedural determinations).

EPA disagrees with the Petitioner's claim that it was required to submit the 2009 Endangerment Finding to the SAB for review under 42 U.S.C. 4365(c)(1), as that provision did not apply. EPA previously addressed this procedural claim in detail, particularly in Response 3-7 in Volume 3 of its 2010 Response to Petitions. As EPA explained in that response, while 42 U.S.C. 4365(c)(1) requires EPA to make "any proposed criteria document, standard, limitation, or regulation" available to SAB, the proposed 2009 Endangerment Finding was not a proposed "criteria

[60] TPP's petition contains a number of other assertions with which EPA does not necessarily agree. However, to the extent those issues are not directly relevant to resolving the substance of TPP's petition, EPA is not further addressing them in this Denial.

document, standard, limitation, or regulation" and thus did not fall within the scope of that provision. EPA also explained in the record for the 2009 Endangerment Finding that it was "not a regulation promulgated under Section 202(a) of the CAA, as they do not include any regulatory text, and they do not impose any requirements on any person other than EPA." (RTC 11-7). Further, even assuming for the sake of argument that the 2009 Endangerment Finding falls within the APA's definition of "rule," that would not change EPA's conclusion that EPA was not required to make the 2009 Endangerment Finding available to the SAB. EPA does not interpret 42 U.S.C. 4365(c)(1) to apply to documents that are not regulations, and are not otherwise specified, but might fit within the APA's expansive definition of "rule."

EPA also provided additional responses regarding the issue of SAB submittal in the 2010 Response to Petitions. *See* RTP, Response 3-7. For example, EPA explained in 2010 that the petitioners objecting to the lack of SAB review had not provided substantial support for the argument that the 2009 Endangerment Finding should be revised, particularly in light of the strength and credibility of the scientific underpinnings of the 2009 Endangerment Finding and the absence of any information indicating that lack of SAB review undermined that scientific basis. *See* RTP, Response 3-7.

TPP fails to identify any new information or changed circumstances that necessitate reconsideration of EPA's prior conclusion that the SAB submittal requirement in 42 U.S.C. 4365(c)(1) did not apply to the 2009 Endangerment Finding. In light of EPA's extensive prior explanations of its grounds for concluding that the SAB submittal requirement did not apply to the 2009 Endangerment Finding, the D.C. Circuit's decision in *Coalition for Responsible Regulation* rejecting challenges to the 2009 Endangerment Finding on this basis, and TPP's failure to identify any new information or changed circumstances that warrant reevaluation of EPA's prior procedures, EPA does not see any basis in TPP's petition for reopening or reconsidering the 2009 Endangerment Finding.

TPP asserts that if EPA had submitted the 2009 Endangerment Finding to the SAB, it would have provided advice that could have led to changes in EPA's approach or analysis. However, EPA's subsequent experience with the SAB refutes that assertion. EPA did provide the SAB information on a later GHG Endangerment Finding under title II of the CAA, the proposed GHG Endangerment and Cause or Contribute Findings under CAA section 231 for Aircraft, which followed an approach that mirrored the agency's approach for the 2009 Endangerment Finding.[61] Consistent with the then-applicable SAB-adopted process for determining whether to initiate review of major planned actions identified in the Unified Regulatory Agenda by EPA, an SAB Work Group was charged with identifying actions for further consideration by the Chartered SAB. *See Memorandum Re: Preparations for Chartered Science Advisory Board (SAB) Discussions of EPA Planned Agency Actions and their Supporting Science in the Fall 2014 Regulatory Agenda*, from James R. Mihelcic, Chair, SAB Work Group on EPA Planned Actions for SAB Consideration of the Underlying Science, to Members of the Chartered SAB and SAB Liaisons (April 28, 2015) ("Mihelcic Memo"). The work group recommended that the 2016 Aircraft Findings did "not merit further SAB consideration," explaining that EPA would rely on work products, including reports prepared by other entities, such as IPCC, USGCRP, and NRC, which "undergo extensive review and thus would not require any further review by the SAB." Mihelcic Memo, Att. C at p. C-20. Further, the work group's recommendation explained that the

[61] 81 Fed. Reg. 54,422 (August 15, 2016).

"approach that EPA will take to making inferences from these work products involves considerations for which there is precedent in the endangerment finding that was made in 2009 under Section 202 of the Clean Air Act" and which had been subject to judicial review. *Id.* at pp. C-20 to C-21. It also noted that the "action clearly deals with issues that involve major environmental risks." *Id.* at p. C-21. These statements counter TPP's suggestion that if the 2009 Endangerment Finding were made available to SAB, it would have identified gaps in EPA's approach or advised changes. SAB may—but is not required to—provide advice or comments on documents or actions made available to it. *See* 42 U.S.C. 4365(c)(2). SAB declined to review the 2016 Findings, "recogniz[ing] that the action will be based on information that has been well-reviewed and that will be based on inference approaches for which there is precedent." Letter from Dr. Peter S. Thorne, Re: Science Advisory Board (SAB) Consideration of EPA Planned Actions in the Fall 2014 Unified (Regulatory) Agenda and their Supporting Science (June 16, 2015) (EPA-SAB-15-009).

Finally, TPP's claim that EPA has inherent authority to reconsider the 2009 Endangerment Finding, coupled with its claim that EPA's "failure to do so triggers reconsideration of the finding," appears to conflate EPA's discretionary authorities with its nondiscretionary duties under the CAA. To the extent EPA has discretion to reconsider the procedures that led to its promulgation of the 2009 Endangerment Finding, EPA declines to exercise that discretion here, for all of the reasons discussed above, and this declination does not trigger any mandatory duty to reconsider the 2009 Endangerment Finding. Accordingly, EPA is denying TPP's request that EPA reopen or reconsider the 2009 Endangerment Finding to make it available to the SAB for review.

# VI. Conclusion

For all of the reasons discussed above, EPA concludes that these four petitions relating to the 2009 Endangerment Finding fail to identify any information or circumstances that warrant rulemaking under the APA. We also find that, to the extent the petitioners seek reconsideration of the 2009 Endangerment Finding under section 307(d)(7)(B) of the CAA, they fail to meet the statutory criteria for such petitions. Accordingly, the petitions are denied.

The decision to deny the four petitions is a final agency action for purposes of section 307(b)(1) of the CAA, which governs judicial review of final actions by the EPA. This action is not a rulemaking and is not subject to the various statutory and other provisions applicable to a rulemaking.

Section 307(b)(1) provides, in part, that petitions for review must be filed in the United States Court of Appeals for the District of Columbia Circuit (D.C. Circuit): (i) when the agency action consists of "nationally applicable regulations promulgated, or final actions taken, by the Administrator," or (ii) when such action is locally or regionally applicable, but "such action is based on a determination of nationwide scope or effect and if in taking such action the Administrator finds and publishes that such action is based on such a determination." For locally or regionally applicable final actions, the CAA reserves to the EPA complete discretion whether to invoke the exception in (ii).

This final action is "nationally applicable" within the meaning of CAA section 307(b)(1). In the alternative, to the extent a court finds this final action to be locally or regionally applicable, the Administrator is exercising the complete discretion afforded to him under the CAA to make and publish a finding that this action is based on a determination of "nationwide scope or effect" within the meaning of CAA section 307(b)(1).[62] This action relates to the 2009 Endangerment Finding, which is nationally applicable. The 2009 Endangerment Finding concerns risks from greenhouse gas pollution and contributions to such pollution that occur across the nation, and the result of the denial of these four petitions is that the existing nationally applicable 2009 Endangerment Finding remains in place and undisturbed. Further, both the 2009 Endangerment Finding and EPA's previous denial of petitions for reconsideration of that Finding were previously reviewed by the D.C. Circuit, *see Coal. for Responsible Regul., Inc. v. EPA*, 684 F.3d 102 (D.C. Cir. 2012) (per curiam) (subsequent history omitted). Moreover, the 2009 Endangerment Finding triggered EPA's statutory duty to promulgate motor vehicle standards under section 202(a) of the CAA, for which judicial review is also only available in the D.C. Circuit and which have effects in more than one federal judicial circuit.[63] For these reasons, this final action is nationally applicable or, alternatively, the Administrator is hereby exercising the complete discretion afforded to him by the CAA to make and publish a finding that this action is based on a determination of "nationwide scope or effect" within the meaning of CAA section 307(b)(1).

[62] In deciding whether to invoke the exception by making and publishing a finding that this final action is based on a determination of nationwide scope or effect, the Administrator has also taken into account a number of policy considerations, including his judgment balancing the benefit of obtaining the D.C. Circuit's authoritative centralized review versus allowing development of the issue in other contexts and the best use of Agency resources.

[63] In the report on the 1977 Amendments that revised section 307(b)(1) of the CAA, Congress noted that the Administrator's determination that the "nationwide scope or effect" exception applies would be appropriate for any action that has a scope or effect beyond a single judicial circuit. *See* H.R. Rep. No. 95–294 at 323, 324, reprinted in 1977 U.S.C.C.A.N. 1402–03.