Exhibit A

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April 1, 2026

VIA ELECTRONIC AND U.S. MAIL

Lee Zeldin, Administrator
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U.S. Environmental Protection Agency
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Washington, D.C. 20460

Aaron Szabo
Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., N.W.
Washington, DC 20460

RE: Petition for Reconsideration of the Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act, 91 Fed. Reg. 7686 (Feb. 18, 2026)

Dear Administrator Zeldin and Assistant Administrator Szabo:

Please find enclosed a Petition for Reconsideration submitted on behalf of the Commonwealths of Massachusetts and Virginia; Josh Shapiro, in his official capacity as Governor of the Commonwealth of Pennsylvania; and the States of Arizona, California, Colorado, Connecticut, Delaware, Hawai‘i, Illinois, Maine, Maryland, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, Vermont, Washington, Wisconsin; the District of Columbia; the Cities of Boston, Massachusetts; Chicago, Illinois; Cleveland, Ohio; Los Angeles, California; New York, New York; and Oakland, California; the Counties of Harris, Texas; Martin Luther King, Jr., Washington; and Santa Clara, California; and the Cities and Counties of Denver, Colorado, and San Francisco, California (collectively, the “States and Local Governments”) with respect to the above-referenced action, Docket ID EPA-HQ-OAR-2025-0194.

Sincerely,

TURNER SMITH
Deputy Bureau Chief

(Attachment)

BEFORE THE HONORABLE LEE ZELDIN, ADMINISTRATOR
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

IN RE PETITION FOR RECONSIDERATION OF RESCISSION OF THE GREENHOUSE GAS ENDANGERMENT FINDING AND MOTOR VEHICLE GREENHOUSE GAS EMISSION STANDARDS UNDER THE CLEAN AIR ACT, 91 FED. REG. 7686 (FEBRUARY 18, 2026)

Submitted by:

COMMONWEALTH OF MASSACHUSETTS; STATE OF CALIFORNIA; STATE OF NEW YORK; STATE OF CONNECTICUT; STATE OF ARIZONA; STATE OF COLORADO; STATE OF DELAWARE; STATE OF HAWAIʻI; STATE OF ILLINOIS; STATE OF MAINE; STATE OF MARYLAND; STATE OF MICHIGAN; STATE OF MINNESOTA; STATE OF NEVADA; STATE OF NEW JERSEY; STATE OF NEW MEXICO; STATE OF NORTH CAROLINA; STATE OF OREGON; JOSH SHAPIRO, IN HIS OFFICAL CAPACITY AS GOVERNOR OF THE COMMONWEALTH OF PENNSYLVANIA; STATE OF RHODE ISLAND; STATE OF VERMONT; COMMONWEALTH OF VIRGINIA; STATE OF WASHINGTON; STATE OF WISCONSIN; DISTRICT OF COLUMBIA; CITY OF BOSTON, MASSACHUSETTS; CITY OF CHICAGO, ILLINOIS; CITY OF CLEVELAND, OHIO; CITY AND COUNTY OF DENVER, COLORADO; HARRIS COUNTY, TEXAS; CITY OF LOS ANGELES, CALIFORNIA; MARTIN LUTHER KING, JR., COUNTY, WASHINGTON; CITY OF NEW YORK, NEW YORK; CITY OF OAKLAND, CALIFORNIA; CITY AND COUNTY OF SAN FRANCISCO, CALIFORNIA; and SANTA CLARA COUNTY, CALIFORNIA.

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INTRODUCTION

On February 18, 2026, the U.S. Environmental Protection Agency (EPA) published the final rule, *Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act*, 91 Fed. Reg. 7686 ("Rescission"). This rule rescinds EPA's 2009 final rule *Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act*, 74 Fed. Reg. 66,496 (Dec. 15, 2009) (2009 Endangerment Finding) and repeals all greenhouse gas emission standards for light-duty (LD), medium-duty (MD), and heavy-duty (HD) vehicles and engines manufactured or imported into the United States for model years (MY) 2012 to 2027 and beyond. Pursuant to Section 307(d) of the Clean Air Act (CAA), and for the reasons set forth below, the Commonwealths of Massachusetts and Virginia; Josh Shapiro, in his official capacity as Governor of the Commonwealth of Pennsylvania; and the States of Arizona, California, Colorado, Connecticut, Delaware, Hawai'i, Illinois, Maine, Maryland, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, Vermont, Washington, Wisconsin; the District of Columbia; the Cities of Boston, Massachusetts; Chicago, Illinois; Cleveland, Ohio; Los Angeles, California; New York, New York; and Oakland, California; the Counties of Harris, Texas; Martin Luther King, Jr., Washington; and Santa Clara, California; and the Cities and Counties of Denver, Colorado, and San Francisco, California (collectively, "States and Local Governments") hereby petition for reconsideration of the Rescission because it introduces and relies on new methodologies, data, inputs, and assumptions that are of central relevance to the Rescission and were not made available for public comment. With the final rule resting on a materially different analytical framework than that described in the proposal, stakeholders could not reasonably have anticipated EPA's reliance on this new modeling approach; accordingly, the Rescission is not a logical outgrowth of the Proposed Rule and violates the CAA.

In the Rescission, EPA contends that it lacks, and has always lacked, the statutory authority to regulate greenhouse gases under section 202(a); and that such regulation is unreasonable in any event. 91 Fed. Reg. at 7688. EPA justifies the rule on three purportedly "independent grounds." *Id.* at 7692. First, EPA asserts that the 2009 Endangerment Finding and subsequent regulations exceeded EPA's statutory authority because section 202 is best read as defining air pollution as pollution that threatens public health or welfare through local or regional exposure; because an endangerment finding cannot be made independently of the issuance of emission standards; and because an endangerment finding cannot be made without also making findings on contribution or causation. *Id.* at 7690. Second, EPA invokes the major questions doctrine, claiming that Congress did not clearly authorize EPA to prescribe this kind of emission standard under section 202(a)(1). *Id.* Third, EPA contends that regulating greenhouse gas emissions under section 202(a)(1) is futile. To support that final justification, EPA relies on a previously undisclosed methodology that estimates the effects of one projection of future emissions from the U.S. motor vehicle sector on global mean surface temperature (GMST) and global sea level rise (GSLR) and compares those effects against purported "range[s] of measurability" for those metrics. *Id.* at 7691, 7732–33. EPA then relies on its futility argument as further support for its arguments regarding statutory authority, and as the sole basis for deeming regulations under section 202(a) "unreasonable." *Id.* at 7691.

That new methodology was a hasty substitute for the one used to support EPA's futility conclusion in the proposed *Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards,* 90 Fed. Reg. 36,288 ("Proposed Rule"). In the Proposed Rule, EPA relied

on the 2025 Climate Working Group (CWG) draft report, which purported to review the existing scientific literature on climate impacts. But after a court deemed the CWG unlawful, EPA decided to introduce newly generated results of four models for estimating emissions inventories and changes in GMST and GLSR caused by those emissions. EPA ran those four models using inputs newly chosen by the agency in order to estimate GMST and GSLR impacts of U.S. motor vehicle emissions. 91 Fed. Reg. at 7729. EPA relied on "the results of [this] modeling" for its determination of futility, which the agency then leveraged in support of repeal on both statutory-authority and reasonableness grounds. *Id*. at 7692, 7711. By introducing and relying upon that new methodology for the first time in the final rule, EPA deprived the States and Local Governments and the public of the opportunity to comment on the evidence cited by EPA as undergirding multiple independent justifications for the Rescission.

The States and Local Governments intend to raise some, if not all, of the legal flaws discussed herein in litigation pursuant to their recently filed petition for review (D.C. Cir. Case No. 26-1061). In requesting reconsideration, the States and Local Governments do not concede that any of the issues discussed in this petition require exhaustion or have not been exhausted. This petition does not and cannot diminish the availability of any issues, facts, and objections in judicial challenges to the Rescission, not limited to those discussed herein.

Because EPA did not disclose its new methodology, including underlying inputs and assumptions, until after the prepublication version of the final rule was made available, it was impracticable for the States and Local Governments to object to that methodology and its applications in the final Rescission. For the same reasons, the grounds for these objections plainly arose after the close of the public comment period and within the "time specified for judicial review." *Alon Refining Krotz Springs, Inc. v. EPA*, 936 F.3d 628, 647–48 (D.C. Cir. 2019). This new methodology undergirds multiple, purportedly independent justifications for the Rescission, and is therefore of central relevance to the final rule. EPA must therefore grant this petition, reopen public comment, and reconsider the Rescission. 42 U.S.C. § 7607(d)(7)(B). EPA must impart all the procedural rights that "would have been afforded had the information been available at the time the rule was proposed." *Id*. Prompt action on this petition is requested to avoid unnecessarily wasting the resources of interested parties and the courts.

BACKGROUND AND PROCEDURAL HISTORY

On August 1, 2025, EPA issued the Proposed Rule, advancing several grounds for repealing the 2009 Endangerment Finding and motor vehicle greenhouse gas emission standards. At least three of those grounds relied extensively on the May 27, 2025, CWG draft report, *A Critical Review of Impacts of Greenhouse Gas Emissions on the U.S. Climate* ("CWG Draft Report"). That report, which was written in secret in less than two months by five handpicked climate skeptics and not subjected to peer review, chiefly consisted of a review of preexisting scientific literature that purportedly "provid[ed] a critical assessment of the conventional narrative on climate change."[1] Relying on that report, the Proposed Rule sought to critique and cast doubt on well-established climate science.

[1] U.S. DEPT. OF ENERGY CLIMATE WORKING GROUP, IMPACTS OF CARBON DIOXIDE EMISSIONS ON THE U.S. CLIMATE (May 27, 2025), EPA-HQ-OAR-2025-0194-0060; *see also Department of Energy Issues Report Evaluating Impact of Greenhouse Gasses on U.S. Climate, Invites Public Comment*, DEP'T OF ENERGY (July 29, 2025), https://perma.cc/S9RJ-GYZ7.

First, EPA claimed in the Proposed Rule that the scientific record "includes too many analytical gaps, uncertainties, and speculative predictions to reach an affirmative endangerment finding and promulgate corresponding emission standards." 90 Fed. Reg. at 36,310. The Proposed Rule's "Climate Science Discussion" cited the CWG Draft Report thirteen times, including to cast doubt on Intergovernmental Panel on Climate Change (IPCC) reports, on mainstream science surrounding ocean acidification, and on the settled understanding that global warming will raise temperatures in the United States. *Id.* at 36,308.

Second, EPA relied on the CWG Draft Report in the Proposed Rule as the sole support for its conclusion that regulating greenhouse gas emissions under CAA section 202(a) would be futile. The CWG Draft Report was EPA's only citation for its assertion that "reducing GHG emissions from all vehicles and engines in the United States to zero would not have a scientifically measurable impact on GHG emission concentrations or global warming potential (2025 CWG Draft Report at 130)." *Id.* at 36,305.

Third, EPA relied on the same citation to the CWG Draft Report to support its argument that section 202(a) requires "the emission [to] cause or contribute to the danger posed by the air pollution to a sufficient extent to satisfy the standard for regulation," noting that EPA "did not consider whether emission standards for new motor vehicles would be futile as a means to address the identified dangers of GHG emissions from all anthropogenic sources." *Id.* at 36,304–05.

The CWG quickly fell apart. Following the report's release, on August 12, 2025, the Environmental Defense Fund and Union of Concerned Scientists filed a complaint in the U.S. District Court for the District of Massachusetts asserting that the CWG was unlawfully established and utilized under the Federal Advisory Committee Act (FACA). Two weeks later, on September 3, 2025, Secretary of Energy Chris Wright dissolved the CWG.[2]

On January 30, 2026, the U.S. District Court for the District of Massachusetts ruled that the CWG's FACA "violations are now established as a matter of law." *EDF. v. Wright*, No.1:25-cv-12249-WGY, 2026 WL 251626, at *1 (D. Mass. Jan. 30, 2026). Consistent with that ruling, the court required the Department of Energy (DOE) to comply with FACA's disclosure requirements. The disclosed documents show that agency leadership at both DOE and EPA worked in close coordination to provide record support to call into question the science undergirding the 2009 Endangerment Finding.[3] *Id.*

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[2] Decl. of Jeff Novak, Ex. 1 at 1, *Env't Def. Fund v. Wright*, No. 1:25-cv-12249 (D. Mass Sept. 4, 2025), ECF No. 44-1 (disbanding CWG one day after close of comment period).

[3] The documents DOE disclosed in compliance with the court's order also reveal close coordination between the CWG, DOE political appointees, and the EPA team working on the Proposed Rule. On April 24, 2025, a DOE political appointee emailed the CWG members, stating: "I'll update you all as soon as we get a new (interim/rushed) deadline from EPA . . .Wright and Zeldin are traveling together today, so we should have an answer soon." Comment submitted by the Environmental Defense Fund, EPA-HQ-OAR-2025-0194-31028 (Jan. 29, 2026), at 10. DOE officials also explicitly tied the draft report to EPA's ongoing efforts to repeal the 2009 Endangerment Finding. For example, one official emailed saying "we have renewed buy-in that EPA will wait for this work and include it in its rulemaking . . . [A CWG member] suggested we increase our coordination with EPA, particularly the legal team drafting the rulemaking." *Id.*

In light of the CWG's collapse, EPA faced a choice of either acknowledging it no longer had a basis for its futility and "de minimis" claims or reopening the comment period with a new basis; instead, EPA chose to simply announce a new factual basis in the final rule in clear violation of the CAA. In the final Rescission, EPA abandoned all citations to the illegally produced CWG draft report, and instead introduced, for the first time, a new futility analysis in a last-ditch effort to substantiate its futility and "de minimis" claims and justify its desired outcome.

Notably, EPA did not publicly release its methodology until *after* the prepublication text of the final Rescission was made available, yet also "did not consider[] or respond[] separately to" the documents disclosed in *EDF v. Wright*, several of which were submitted to the regulatory docket after the comment period,[4] nor to the nearly 250 other "comments received after the comment period," because, the agency claimed, those comments "raised only a few new and novel issues."[5] In other words, in its rush to finalize the rule, EPA dismissed material comments submitted after the close of the comment period, despite itself generating and relying upon entirely new modeling data that were added to the regulatory docket only after the prepublication version of the Rescission was made available.

EPA's new methodology includes several fundamental assumptions and inputs, all of which were announced for the first time in the prepublication version of the final Rescission. First, EPA used two models, OMEGA and MOVES, with its own previously undisclosed assumptions about how the U.S. motor vehicle fleet will change going forward, to project one pathway for the evolution of the U.S. LD, MD, and HD vehicle fleets through 2100 and estimate future greenhouse gas emissions from those fleets over that timeframe. *Id.* at 7729. Second, EPA used the Finite amplitude Impulse Response (v2.2.3) climate emulator model ("FaIR model") and the Building Blocks for Relevant Ice and Climate Knowledge model ("BRICK model") to estimate the impacts of those estimated emissions and a single projection of all estimated future greenhouse gas emissions from other sources on GMST and GSLR, respectively. EPA also provided estimates using *half* the projected emissions from U.S. motor vehicles on the assumption that the greenhouse gas emissions standards for model years 2027–2032 repealed in this action would have eliminated 50 percent of U.S. motor vehicle emissions over those vehicles' lifetimes. *Id.* at 7732. Third, EPA asserted the GSLR and GMST impacts were "de minimis" under "any reasonable understanding." *Id.* More precisely, EPA argued that the GMST and GSLR impacts from total elimination of U.S. vehicles' greenhouse gas emissions were below the "range of measurability for GMST and likewise for GSLR" and, for GMST, below "GMST variability from 2016–2025," citing certain sources from the National Oceanic and Atmospheric Administration (NOAA). *Id*. at 7733. EPA also argued the GMST and GLSR impacts from its 50-percent scenario were below 1 percent and therefore *de minimis*. *Id.*

Meanwhile, on January 30, 2026, the Massachusetts Office of the Attorney General requested an EO 12866 meeting regarding the Rescission on behalf of the Attorneys General of Massachusetts, California, Colorado, Minnesota, New York, and Oregon. The States planned to raise, *inter alia*, the recent district court decision in the FACA litigation, discussed *supra,* and to reassert that, if EPA sought to substitute new data and analysis to support assertions made in the Proposed Rule, including relying on the illegally produced CWG draft report to support its

[4] *Id.* (including attachments).

[5] EPA, RECONSIDERATION OF 2009 ENDANGERMENT FINDING AND GREENHOUSE GAS VEHICLE STANDARDS, RESPONSE TO COMMENTS ii (Feb. 2026) [hereinafter "RESPONSE TO COMMENTS"].

futility and "de minimis" claims, EPA must subject those data and analysis to a new round of notice and comment.[6] The White House Office of Information and Regulatory Affairs (OIRA) scheduled, and the States promptly confirmed, a meeting with EPA and OIRA staff to be held on February 12, 2026, at 3:00 p.m. Eastern Time.

The States never had the chance to meet with OIRA or EPA, however. Rather than meet with the States, on February 12, EPA Administrator Zeldin held a press conference with President Trump at 1:00 p.m. Eastern Time to announce that the Rescission was "over, done, finished" and had been "signed, sealed, delivered."[7] The States were left with a dead conference line. The States did not receive a cancellation notice until a week after the scheduled call, on February 19, 2026 (after the Rescission had appeared in the Federal Register).

LEGAL STANDARD

The CAA requires that data and methodologies that are central to the agency's justification(s) for a rule be placed in the docket as soon as they are available and be subject to public comment. In general, EPA may not rely on new factors or methodologies in a final rule that were not previously considered and made available for public comment. *See Small Refiner Lead Phase-Down Task Force v. EPA*, 705 F.2d 506, 540 (D.C. Cir. 1983); *Kennecott Corp. v. EPA*, 684 F.2d 1007, 1018 (D.C. Cir. 1982); *Am. Petrol. Inst. v. Costle*, 665 F.2d 1176, 1190 (D.C. Cir. 1981).

Under section 307(d)(7)(B) of the CAA, 42 U.S.C. § 7607(d)(7)(B), EPA must convene a reconsideration proceeding if a person raising an objection shows (1) it was "impracticable" to raise the objection during the public comment period, or grounds for the objection arose after the public comment period but within the time specified for judicial review; and (2) the objection "is of central relevance to the outcome of the rule." Impracticability turns on whether the notice of proposed rulemaking provided "adequate notice" of the final rule. *Clean Air Council v. Pruitt*, 862 F.3d 1, 10 (D.C. Cir. 2018).

An objection is "of central relevance" if it provides "substantial support for the argument that the regulation should be revised." *Chesapeake Climate Action Ntwk. v. EPA*, 952 F.3d 310, 322 (D.C. Cir. 2020). Where the requirements of section 307(d)(7)(B) are met, EPA must conduct a reconsideration proceeding that includes notice and comment.

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[6] *See* Comments of the Attorneys General of Massachusetts, et al. (Endangerment Comment), EPA-HQ-OAR-2025-0194-13587 (Sept. 22, 2025), at 201 ("To the extent that EPA, after the public comment period, attempts to address any of the Proposal's myriad defects with additional information or analysis, it must offer a new opportunity for comment.").

[7] PBS NewsHour, *WATCH LIVE: Trump, Zeldin to announce end of scientific basis for U.S. action on climate change*, YOUTUBE (Feb. 12, 2026), http://youtu.be/9cSWL_UpFGA.

ARGUMENT

EPA MUST TAKE NOTICE AND COMMENT ON THE NEW METHODOLOGIES, INPUTS, AND ASSUMPTIONS IT RELIED ON IN THE FINAL RESCISSION TO CONCLUDE THAT ANY AND ALL GREENHOUSE GAS STANDARDS ISSUED UNDER SECTION 202(A)(1) WOULD MEET THE PURPORTED STANDARD FOR FUTILITY.

The CAA requires that EPA disclose in the notice of proposed rulemaking "the factual data on which the proposed rule is based" and "the methodology used in obtaining the data and in analyzing the data." 42 U.S.C. § 7607(d)(3). In the final Rescission, however, EPA relied on a previously undisclosed methodology for this rulemaking—analyzing a newly generated dataset based on previously unarticulated inputs and assumptions—that was not made public until after the rule became final. Because EPA relies on this new methodology for multiple allegedly independent justifications of the Rescission, this objection is of central relevance to the rule in its entirety.

As detailed above, in the Proposed Rule, EPA principally relied on the now-abandoned CWG Draft Report to support its futility rationale. 90 Fed. Reg. at 36,304–05. EPA first cited the CWG Draft Report to propose that "[r]educing GHG emissions from light- and medium-duty vehicles in the United States to zero would result in ... an approximate 3 percent reduction in predicted warming trends." *Id.* at 36,111. EPA then again cited the CWG Draft Report to contend that "[g]lobal warming trends from 1979 to 2023, the period with the best available data, were determined to a precision (or margin of error) of plus or minus 15 percent total (*id*. [citing CWG draft report at 130])." *Id.* Comparing the two purported estimates—drawn entirely from the CWG Draft Report—EPA then proposed to conclude, "An estimated 3 percent reduction in global warming trends is well below the scientific threshold for measurability and is not a reliable measure for regulatory purposes." *Id*. The CWG Draft Report did not contain any modeling, analysis, or citations to other authorities (much less peer-reviewed literature) to justify either the 3 percent impact on the undefined "overall warming trend" or the 15 percent margin-of-error it used for its futility argument.[8]

As a result of the CWG's downfall, in the final Rescission, EPA sought to salvage its unsupported claims by abandoning the fatally flawed CWG Draft Report only to make another fatal error by attempting to substitute a different methodology not previously part of this rulemaking. In the final Rescission, EPA performed this substitution well after the close of the public comment period and did not make its methodology publicly available until after the prepublication text of the final rule was made available. *Id.* at 7691.

Specifically, EPA relied solely on newly modeled impacts to "trends in GSLR and GMST," as detailed above, "as a separate but complementary basis for rescission and repeal," 91 Fed. Reg. at 7702, based on the assumption that "health and welfare harms [are] attributed primarily to trends in GMST and GSLR," *id.* at 7711. As EPA explained:

> "[W]e are finalizing that GHG emission standards under CAA section 202(a)(1) do not have more than a *de minimis* impact on the health and welfare dangers identified in the Endangerment Finding *because* even the complete elimination of GHG

[8] *See* Comments of the Attorneys General of California, et al. (Vehicles Comment), EPA-HQ-OAR-2025-0194-2974 (Sept. 22, 2025), at 77–80 (critiquing the above methodology for evaluating "futility").

> emissions from new and existing LD, MD, and HD vehicles would not materially impact GMST or GSLR as a proxy for adverse impacts to public health and welfare.

91 Fed. Reg. at 7694 n.27 (emphasis added).

In other words, according to EPA, the entirely new modeling data and the accompanying assumptions (including the suitability of GMST and GSLR as proxies based on this modeling)[9] were necessary to resolve competing views of the impacts of section 202(a)(1) regulation on public health and welfare. Thus, the new, EPA-generated data—not anything specific in responsive public comments—is "the available information" on which EPA relied for its conclusion. *Id.* at 7710.

EPA completely failed to disclose this methodology, including the use of these models, inputs and underlying assumptions, until the final Recission. This is the *exact* scenario that CAA section 307(d) is designed to prevent: wholesale replacement between proposed rule and final rule of the alleged empirical basis for a core tenet of the rule. EPA's belated introduction of and reliance on this new methodology plainly flouts section 307 and warrants granting this petition. *Compare Kennecott Corp. v. EPA*, 684 F.2d 1007, 1018 (D.C. Cir. 1982) (finding a violation of section 307 notice requirements where "neither the actual tests nor the methodology used by EPA" were placed in the docket before or during the public comment period), *with Sierra Club v. Costle*, 657 F.2d 298, 333 (D.C. Cir. 1981) (finding no notice issue where "the utility model itself and its key assumptions were discussed in the proposed rule and background documents").

Appearing to recognize its error, EPA attempts to claim that this new evidence consists of "existing models."[10] But that misstates the legal test applicable here: the relevant question is not the novelty of this type of model in general, or even these specific models, but the novelty of using these models, on these datasets and with these assumptions, in this proceeding, and for this purpose—with none of those methodological elements having been subject to public comment. These models are well established; but EPA's use of them in this way, to make final decisions about the scope of EPA's statutory authority or the reasonableness of any regulation, is unprecedented, in this rulemaking and more broadly. In the Proposed Rule, EPA simply did not use or even suggest it would use these models and this set of assumptions for the purpose set forth in the final rule. Nor does EPA's oblique reference to unspecified data and methodologies on futility proffered by unspecified commenters cure its flaw; as noted above, EPA made clear its futility analysis rested on its new methodology. 91 Fed. Reg. at 7710, 7728. (And to the extent it

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[9] Because EPA relies on a new methodology in the final rule, the States and Local Governments did not have a fair opportunity to comment on EPA's use of the outputs of that new methodology, i.e., the calculated trends in GMST and GSLR based on new inputs and assumptions, as the measure of adverse impacts to public health and welfare. This issue is distinct from objections raised during the public comment period to EPA's general assumption that GMST and GSLR are reasonable proxies for adverse impacts to public health and welfare under section 202(a), to which EPA responded. *See* RESPONSE TO COMMENTS, *supra* note 5, at 215, 219 ("commenter stated that the EPA should utilize a different metric for consideration of futility that is not temperature change or sea-level rise."). Regardless, EPA's reliance on changes to GMST and GSLR as proxies for adverse impacts to public health and welfare is a "key assumption" undergirding the final rule. *AFPM v. EPA*, 937 F.3d 559, 589 (D.C. Cir. 2019).

[10] RESPONSE TO COMMENTS, *supra* note 5, at 7.

did rest on commenters' new data and methodology, *those*, too, would need to be subject to notice and comment.)

Notably, EPA relies on this new methodology for not only the futility rationale, but also other purportedly independent rationales for the Rescission, thus tainting the rule in its entirety. In particular, EPA cites its futility rationale, which relies solely on this new modeling and assumptions, as informing EPA's best reading of section 202(a)(1) and the endangerment/contribution criteria. 90 Fed. Reg. at 7716–17 (the conclusion that "agencies have implied authority to exempt *de minimis* concerns . . . informs our interpretation of CAA section 202(a)(1) by suggesting that the provision does not encompass the attenuated chain of causation required to invoke the authority to regulate GHG emissions where regulations cannot have more than a trivial impact on the identified dangers to health and welfare"); *id.* at 7710–11 ("the inability of GHG emission standards to have a material (*i.e.*, non-*de minimis*) impact on the dangers attributed to global climate change in the Endangerment Finding informs our statutory interpretation."). The output of the new modeling and assumptions also permeates EPA's separately articulated rationale invoking the major questions doctrine. *Id.* at 7724 ("even eliminating all GHG emissions from all U.S. vehicles and engines would have only a *de minimis* impact on GMST and GLSR trends as a proxy for adverse health and welfare impacts."). The public must have the opportunity to comment on the modeling, inputs, and assumptions undergirding all of EPA's purportedly independent grounds for repeal. *Id.* at 7692, 7711.

RELIEF REQUESTED

For the foregoing reasons, the States and Local Governments respectfully request that, pursuant to 42 U.S.C. § 7607(d)(7)(B), the Administrator convene a proceeding for reconsideration of the Rescission and afford the interested public the procedural rights due to them.

Dated: April 1, 2026

Respectfully submitted,

COMMONWEALTH OF MASSACHUSETTS
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April 14, 2026

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Re: Petition for Reconsideration of Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act, 91 Fed. Reg. 7686 (February 18, 2026)

Dear Administrator Zeldin and Assistant Administrator Szabo:

On behalf of the Zero Emission Transportation Association (ZETA), enclosed please find a petition for mandatory reconsideration of the above-referenced rule, submitted under Section 307(d)(7)(B) of the Clean Air Act, 42 U.S.C. § 7607(d)(7)(B).

Please direct any questions regarding this submission to the undersigned.

Respectfully submitted,

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Petition for Reconsideration of EPA's Final Rule:
Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act

Pursuant to Section 307(d)(7)(B) of the Clean Air Act (CAA), 42 U.S.C. § 7607(d)(7)(B), the Zero Emission Transportation Association (ZETA) hereby petitions for reconsideration of EPA's final rule entitled, "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act." 91 Fed. Reg. 7686 (Feb. 18, 2026) (Rescission Rule).

ZETA is a federal coalition committed to enacting policies that drive electric vehicle (EV) adoption. The Association's members span the entire EV supply chain—including vehicle manufacturers, charging infrastructure manufacturers, network operators, battery manufacturers and recyclers, electricity providers, and critical minerals producers, among others.

Mandatory reconsideration is necessary here because the Rescission Rule rests on new methodologies, data, inputs, and assumptions that were not made available for public comment and that are of central relevance to the Rescission Rule. Because EPA's final rule is grounded in an analytical framework that differs materially from the one in the proposal—meaning stakeholders could not reasonably have anticipated EPA's new modeling approach—the Rescission Rule fails the logical outgrowth test and violates the CAA.

ZETA hereby adopts in full the arguments in the April 1, 2026 petition for reconsideration of the same rule filed by States and Local Governments,[1] and respectfully requests that EPA grant the petitions, reopen comment, and reconsider the Rescission Rule. *See* 42 U.S.C. § 7607(d)(7)(B). ZETA urges EPA to act on the petitions promptly, in order to avoid wasting party and judicial resources.[2]

A. Background on the Rescission Rule

On August 1, 2025, EPA published a proposed rule, 90 Fed. Reg. 36,288 (Proposed Rule), that advanced several grounds for repealing the 2009 rule entitled, "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 Fed. Reg. 66,496 (Dec. 15, 2009) (2009 Endangerment Finding). Throughout the Proposed Rule, EPA cited to a draft report by the "Climate Working Group" (CWG)—an ad hoc group of climate skeptics—which purported to survey the existing scientific literature on climate change. The

[1] *See* Commonwealth of Massachusetts et al., Petition for Reconsideration of the Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act, 91 Fed. Reg. 7686 (Feb. 18, 2026) (Apr. 1, 2026).

[2] ZETA does not concede that exhaustion through reconsideration is necessary to raise any of the issues discussed in this petition, or in the previously filed States and Local Governments' petition, in the litigation challenging the Rescission Rule.

Proposed Rule relied on the CWG draft report for EPA's assertion that regulating greenhouse gas emissions under CAA Section 202(a)(1) would be futile, because eliminating all U.S. vehicle greenhouse gas emissions would purportedly not produce a scientifically measurable impact on global warming. 90 Fed. Reg. at 36,304–05.

The CWG unraveled after the Proposed Rule's publication. The Secretary of Energy disbanded the CWG on September 3, 2025—one day after the close of the public comment period for the Proposed Rule. Then, in January 2026, the U.S. District Court for the District of Massachusetts held that the CWG violated the Federal Advisory Committee Act. *EDF v. Wright*, No. 1:25-cv-12249, 2026 WL 251626 (D. Mass. Jan. 30, 2026).

On February 18, 2026, EPA published the final Rescission Rule, rescinding the 2009 Endangerment Finding and all greenhouse gas emission standards for light-duty, medium-duty, and heavy-duty vehicles and engines for model years 2012 to 2027 and beyond.

In the wake of the CWG's collapse, EPA decided in the final Rescission Rule to abandon all reliance on the CWG draft report, substituting it with new and previously undisclosed climate modeling. Specifically, EPA relied on newly generated results of four models—the OMEGA, MOVES, FaIR, and BRICK models—using inputs and assumptions of EPA's own choosing to project future U.S. vehicle fleet emissions and to estimate resulting changes in global mean surface temperature (GMST) and global sea level rise (GSLR). 91 Fed. Reg. at 7729–33. EPA relied on the results of that new modeling to support its futility rationale, which the Agency then invoked in support of the other purportedly independent bases for the Rescission Rule. *See id.* at 7692, 7711.

EPA did not make this new modeling, including its data, inputs, and assumptions, available until after the final Rescission Rule was released, in clear violation of the CAA.[3] *See Kennecott Corp. v. EPA*, 684 F.2d 1007, 1018 (D.C. Cir. 1982) (CAA Section 307 violated where "neither the actual tests nor the methodology used by EPA" were placed in the docket before or during the comment period). Meanwhile, EPA dismissed nearly 250 post-comment-period submissions, including documents disclosed in *EDF v. Wright*, as raising "only a few new and novel issues."[4] EPA thus held the public to a comment deadline that the Agency itself did not respect.

[3] EPA's rejoinder that it merely applied "existing models" misses the point. EPA, Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act: Response to Comments, EPA-HQ-OAR-2025-0194-31089, at 7 (Feb. 18, 2026) (Response to Comments). The relevant question is not whether the models themselves are familiar, but whether EPA's specific application of them—on these datasets, with these inputs and assumptions, for this specific purpose in this proceeding—was ever subject to public comment. It was not.

[4] Response to Comments at ii; *see, e.g.*, Environmental Defense Fund, Supplemental Comment of Environmental Defense Fund on *Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards*, 90 Fed. Reg. 36288 (Aug. 1, 2025), EPA-HQ-OAR-2025-0194-31028 (Jan. 29, 2026) (including attachments).

B. Mandatory Reconsideration is Required Here

EPA must grant reconsideration and reopen public comment on the new methodology used in the Rescission Rule. Reconsideration under CAA Section 307(d)(7)(B) is mandatory where a petitioner demonstrates: (1) it was impracticable to raise the objection during the comment period, or the grounds for the objection arose after the comment period but within the time for judicial review; and (2) the objection is of central relevance to the rule. *See* 42 U.S.C. § 7607(d)(7)(B). Both elements are met here.

Impracticability; Grounds Arose After Comment Period. EPA did not disclose its new modeling methodology, including underlying inputs and assumptions, until after the final Rescission Rule was released. Because the Proposed Rule relied instead on the CWG report, the public could not have anticipated EPA would rely on this different analytical framework. It was therefore impracticable for ZETA and other interested parties to object to EPA's new approach during the public comment period. In addition, the grounds for objection plainly arose after that period closed and within the time period specified for judicial review. *See Chesapeake Climate Action Ntwk. v. EPA*, 952 F.3d 310, 320–22 (D.C. Cir. 2020) (impracticability met where "[t]here was simply no opportunity for Petitioners to weigh in" on the analytical approach adopted by final rule).

Central Relevance. The new modeling is of central relevance to the rule because EPA explicitly relies on it to support each of its purportedly "independent" grounds for rescission. 91 Fed. Reg. at 7692. First and most directly, EPA's futility rationale rests entirely on the new modeling. *Id.* at 7694 n.27. Second, EPA invokes that same futility conclusion to inform its statutory interpretation, reasoning that the inability of vehicle GHG standards to have a "non-de minimis" impact "informs our interpretation of CAA section 202(a)(1)." *Id.* at 7710–11, 7716–17. Third, EPA incorporates the new modeling output into its major questions doctrine analysis, asserting that "even eliminating all GHG emissions from all U.S. vehicles and engines would have only a de minimis impact on GMST and GSLR trends." *Id.* at 7724. Because the objection provides "substantial support for the argument that the regulation should be revised," *Chesapeake Climate*, 952 F.3d at 322, it satisfies the central-relevance requirement.

* * *

For the foregoing reasons, ZETA respectfully requests that the Administrator convene a proceeding for reconsideration of the Rescission Rule under 42 U.S.C. § 7607(d)(7)(B), reopen the public comment period with disclosure of the new methodology, data, inputs, and assumptions relied upon in the final rule, and afford ZETA and the interested public the full procedural rights to which they are entitled under the CAA.

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Exhibit C

PETITION FOR RECONSIDERATION OF EPA'S FINAL RULE: RESCISSION OF THE GREENHOUSE GAS ENDANGERMENT FINDING AND MOTOR VEHICLE GREENHOUSE GAS EMISSION STANDARDS UNDER THE CLEAN AIR ACT

Docket No. EPA-HQ-OAR-2025-0194

April 15, 2026

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Environmental Defense Fund, Natural Resources Defense Council, Union of Concerned Scientists, Earthjustice, Sierra Club, Clean Air Task Force, Environmental Law & Policy Center, Conservation Law Foundation, Public Citizen, Physicians for Social Responsibility, Clean Wisconsin, Clean Air Council, American Public Health Association, American Lung Association, Center for Biological Diversity, and Alliance of Nurses for Healthy Environments (collectively "Petitioners"), hereby request that the U.S. Environmental Protection Agency ("EPA" or "Agency") reconsider specified aspects of the Final Rule titled "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act," 91 Fed. Reg. 7686 (Feb. 18, 2026) ("Final Rule").

I. INTRODUCTION

On February 18, 2026, the U.S. Environmental Protection Agency ("EPA") published the Final Rule, which rescinds the Administrator's foundational and critically important 2009 decision entitled "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," 74 Fed. Reg. 66496 (Dec. 15, 2009) ("Endangerment Finding"), and repeals all greenhouse gas (GHG) emission standards for new light-duty (LD), medium-duty (MD), and heavy-duty (HD) vehicles and engines manufactured in or imported into the United States for model years (MY) 2012 to 2027 and beyond.[1]

EPA issued the Endangerment Finding under Clean Air Act section 202(a)(1) based on its exhaustively supported conclusion that GHGs endanger public health and welfare. The Agency found that emissions from new motor vehicles and engines "contribute" to "air pollution," defined as the accumulated global concentrations of the six "well-mixed" GHGs, that endangers public health and welfare by giving rise to climate change dangers.[2] As required under Clean Air Act section 202(a)(1), after making the requisite Endangerment Finding, EPA issued GHG emission standards for new motor vehicles and engines. EPA has adopted regulations updating its vehicle GHG emission standards multiple times over the past sixteen years, each time reaffirming the validity of the Endangerment Finding.

In an about-face, EPA now contends that the Endangerment Finding and subsequent mobile source GHG regulations exceeded the Agency's authority under Clean Air Act section 202(a)(1).[3] Numerous state and local governments, public health, environmental, and labor organizations, industry trade groups, and other parties—including the undersigned Petitioners—have filed timely petitions for review of the Final Rule in the U.S. Court of Appeals for the D.C. Circuit, and those cases are pending. *See American Public Health Association v. EPA*, Case No. 26-1037 (D.C. Cir. 2026) and associated cases.

Under Clean Air Act section 307(b)(1), parties challenging EPA rules must petition for judicial review of a rule within 60 days of the rule's publication in the Federal Register.[4] Section

[1] 91 Fed. Reg. at 7688.
[2] 74 Fed. Reg. at 66536-37.
[3] 91 Fed. Reg. at 7689.
[4] 42 U.S.C. § 7607(b)(1).

307(d)(7)(B) provides that if "it was impracticable" to raise an objection to an issue "of central relevance to the outcome of [a final] rule," a party must seek administrative reconsideration before raising those issues in judicial review.[5] As explained below, EPA's notice of proposed rulemaking failed to provide adequate notice as to the issues raised in this petition, and it was therefore impracticable for Petitioners to raise the objections presented herein during the public comment period.[6] The objections described in this reconsideration petition identify numerous and foundational flaws in EPA's rationales for the Final Rule that, if corrected, present a substantial likelihood that EPA would have reached a different outcome, and that are therefore centrally relevant to the outcome of the rule.[7] Pursuant to Clean Air Act section 307(d)(7)(B), and for the reasons set forth below, Petitioners hereby petition EPA to reconsider these aspects of the Final Rule.[8] To promote efficient resolution of disputes over the Final Rule, EPA should act swiftly on this petition, grant the requested reconsideration on the issues described herein, and reopen an opportunity for public comment on these issues.

We note that parties may have disputes over whether a particular objection was already exhausted or was subject to the reconsideration process outlined in Clean Air Act section 307(d)(7)(B), and that definitive judicial resolution of that uncertainty may come after the time for submitting the objection to the Agency has expired. Petitioners also note that section 307(d)(7)(B)'s exhaustion requirement is not jurisdictional and can be waived by the Agency.[9] Accordingly, Petitioners reserve the right to press the objections presented herein in their pending judicial challenges.

The balance of the petition begins in section II by articulating the standard for Clean Air Act section 307(d)(7)(B) reconsideration. Section III explains that EPA introduced entirely new modeling and *de minimis* theories in the Final Rule to support its futility finding, and recast futility as an independent basis for rescinding both the Endangerment Finding and all vehicle GHG standards, none of which was a logical outgrowth of the proposal. As such, commenters had no chance to scrutinize or rebut the undisclosed models, assumptions, and thresholds that now drive the agency's dispositive conclusions.

Section IV addresses the Final Rule's new technical futility analysis, which abandons the

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[5] *Id.* § 7607(d)(7)(B).

[6] Alternatively, EPA's Final Rule presents grounds arising after the comment period. This petition demonstrates that the objections herein meet both bases for mandatory reconsideration under Clean Air Act section 307(d)(7)(B).

[7] In support of this petition, we are also submitting several appendices, our modeling files, and additional documents, which provide supporting technical analysis for the objections raised herein. We further describe these submissions in section VIII.

[8] If EPA were to conclude that Clean Air Act Section 307(d)(7)(B)'s criteria for mandatory reconsideration are not met, EPA should still reconsider the Final Rule under Administrative Procedure Act section 553(e), 5 U.S.C. § 553(e), so that the serious errors and missteps identified herein are corrected.

[9] *EPA v. EME* Homer *City Generation, L.P.*, 572 U.S. 489, 511-12 (2014) (concluding that section 307(d)(7)(B)'s exhaustion requirement is not "jurisdictional," and proceeding to address merits of challengers' objections to rule, because EPA had failed to "unequivocally" press failure-to-exhaust argument in the D.C. Circuit).

proposal's reliance on the Climate Working Group (CWG) report and instead models the percentage contribution of all U.S. vehicle CO_2 emissions, beginning in Model Year (MY) 2027, to changes in global mean surface temperature (GMST) and global sea level rise (GSLR). EPA then reduces modeled impacts by 50% in a so-called "illustrative" scenario. Among other things, EPA errs in solely relying on global average temperature and sea level change metrics that obscure massive health and welfare harms to the United States, makes irrational modeling choices that assume the emissions benefits of the GHG program to assert that the same program is meaningless, and relies on a so-called "illustrative" scenario with back-of-the-envelope calculations that the Agency concedes applies "analytic tools not intended for this purpose."[10] This section details our objections to these modeling choices, and the dramatically different outputs that would result from different choices, showing the central relevance of EPA's failure to expose its new futility analysis to public scrutiny.

Section V addresses the Final Rule's new *de minimis* yardsticks—global temperature and sea level "measurability," global temperature "variability" for 2016–2025, and a 1% contribution threshold—against which EPA compares the global temperature and sea level rise impacts of U.S. vehicle GHGs. Petitioners demonstrate that EPA's measurability and variability assertions conflate entirely distinct technical concepts, rely on numbers that do not exist even in the Agency's cited sources, and make numerous basic statistical errors. EPA's third *de minimis* yardstick—a 1% contribution threshold—has no basis in judicial precedent and arbitrarily neglects the context of climate change, where a 1% contribution translates into catastrophic health and welfare damages.

Throughout sections IV and V, we also show that, after addressing EPA's numerous technical errors, U.S. vehicle emissions' impacts on temperature and sea level rise easily exceed EPA's alleged *de minimis* thresholds, in some cases by over an order of magnitude, making such impacts meaningful even under EPA's flawed futility methodology. For example, section V.A.2 reports potential sea level rise impacts nearly 36 times the amount of measurement uncertainty, and potential temperature impacts 24 times the amount of measurement uncertainty and nearly 14 times the amount of variability. Section IV.C.2 further demonstrates that, even assuming the Final Rule's modeling inputs, U.S. vehicle GHGs cause massive human health and welfare harms of $17.6 trillion by 2100, an amount that is not *de minimis* by any reasonable measure.

Lastly, Section VI addresses EPA's abrupt Final Rule decision not to monetize ozone and fine particulate matter ($PM_{2.5}$) co-benefits, which reverses longstanding practice without new science or adequate explanation and erroneously treats these critical public health benefits that reduce toxic soot and smog as worth zero dollars.

II. STANDARD FOR RECONSIDERATION

Clean Air Act section 307(d)(7)(B) provides:

> 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

[10] 91 Fed. Reg. at 7732.

> 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.[11]

Employing the mandatory "shall," the section *mandates* that EPA convene a reconsideration proceeding upon the required demonstration. A fundamental purpose of the reconsideration process is to grant the public an opportunity to timely comment on important aspects of a Final Rule that were not properly noticed in a proposed rule.[12]

For rulemakings such as the Final Rule, section 307(d)(3) of the Clean Air Act requires EPA to provide notice of its proposed action that "shall be accompanied by a statement of its basis and purpose," including "the factual data on which the proposed rule is based; ... the methodology used in obtaining the data and in analyzing the data; and ... the major ... policy considerations underlying the proposed rule."[13] These notice requirements are designed "(1) to ensure that Agency regulations are tested via exposure to diverse public comment, (2) to ensure fairness to affected parties, and (3) to give affected parties an opportunity to develop evidence in the record to support their objections to the rule and thereby enhance the quality of review."[14] "[I]f the Final Rule deviates too sharply from the proposal, affected parties will be deprived of notice and opportunity to respond to the proposal."[15] "[A]mbiguous comments and weak signals from the Agency g[i]ve petitioners no . . . opportunity to anticipate and criticize the rules or to offer alternatives. Under these circumstances, the … rules exceed the limits of a logical outgrowth."[16] Therefore, considering the purposes of notice, a final rule that is not the logical outgrowth of a proposed rule does not provide the public with meaningful notice under section 307(d)(3).[17] And critically for purposes of this petition, objections to aspects of a final rule that did not grow logically from the proposed rule are, necessarily, ones that were "impracticable to raise" or the grounds for which arose only after the public comment period. Even if EPA's conclusion were a logical outgrowth of the proposal, findings and analyses underlying the conclusion that were not disclosed in the proposal are the proper subject of mandatory reconsideration.[18]

An objection is of central relevance if it "provides substantial support for the argument that

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[11] 42 U.S.C. § 7607(d)(7)(B) (emphasis added).

[12] Furthermore, EPA has discretion to reconsider its actions even where the standard for mandatory reconsideration is not met.

[13] 42 U.S.C. § 7607(d)(3).

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[14] *Envt'l Integrity Project v. EPA*, 425 F.3d 992, 996 (D.C. Cir. 2005) (quoting *United Mine Workers of America v. Mine Safety & Health Admin.*, 407 F.3d 1250, 1259 (D.C. Cir. 2005).

[15] *Small Refiner Lead Phase-Down Task Force v. EPA* ("*Small Refiner*"), 705 F.2d 506, 547 (D.C. Cir. 1983).

[16] *United Mine Workers of America*, 407 F.3d at 1261 (citation omitted).

[17] *See Env't Integrity Project*, 425 F.3d at 996-97.

[18] *Chesapeake Climate Action Network v. EPA*, 952 F.3d 310, 320-21 (D.C. Cir. 2020).

the regulation should be revised."[19] An objection that "go[es] to the very legality" of the Final Rule satisfies this test,[20] even if EPA could conceivably claim alternative support for its action.

III. RECONSIDERATION IS MANDATED

Reconsideration under Clean Air Act section 307(d)(7)(B) is mandated here because Petitioners raise multiple objections, as detailed in this petition, that were impracticable to raise during the comment period because they were not noticed in the Proposal, and they concern issues of central relevance to the Final Rule. In particular, Petitioners object to EPA's reliance on modeling and technical analyses that EPA performed *after* the period for public comment on the proposed rule, and that underpin EPA's bases for rescinding the Endangerment Finding and associated vehicle GHG emission standards. Petitioners did not have an opportunity to assess and object to these new technical methodologies and analyses, and resulting findings and conclusions, during the public comment period, and indeed, could not possibly have done so given that they became available only after the close of the comment period. EPA also articulates certain novel legal and policy justifications for the first time in the Final Rule as to repeal of the Endangerment Finding and the vehicle GHG emission standards based on new futility analyses and *de minimis* metrics. Finally, EPA takes the position for the first time in the Final Rule that it cannot monetize health co-benefits associated with ozone and $PM_{2.5}$ reductions.

As described further in this petition, these justifications for repeal were not properly noticed. When information such as new modeling and findings are made available for the first time in a final rule, the "the [Clean Air] Act provides an orderly process for raising objections that a party had no opportunity to press during the public comment period."[21] Additionally, Petitioners' objections to these issues are of central relevance as they directly challenge the legality of the Final Rule.[22] If EPA had properly noticed these issues for public comment, commenters would have identified critical modeling flaws, analytical inconsistencies, unsupportable assumptions, and other objections to EPA's analysis and methodologies. There is a substantial likelihood that public input would have affected EPA's final findings and rationales regarding rescission of the Endangerment Finding and all vehicle GHG emission standards based on futility and new *de minimis* metrics, all of which are centrally relevant to the Final Rule. EPA must therefore convene a Clean Air Act section 307(d)(7)(B) proceeding for reconsideration as the forum for the public to evaluate such new modeling and analyses that are at the heart of the Final Rule.

Furthermore, the Final Rule's new justifications for rescinding the Endangerment Finding and the vehicle GHG standards are based on entirely new modeling results, technical analyses, and policy positions that are not the logical outgrowth of analysis presented in the proposed rule. Particularly, EPA claims that it performed this new modeling "to evaluate the competing data and

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[19] *Coal. for Responsible Regul. v. EPA*, 684 F.3d 102, 125 (D.C. Cir. 2012), *aff'd in part, rev'd in part on other grounds sub nom. Util. Air Regulatory Grp. v. EPA*, 573 U.S. 302 (2014) (citation omitted).
[20] *Chesapeake Climate Action Network*, 952 F.3d at 322.
[21] *Masias v. EPA*, 906 F.3d 1069, 1075-76 (D.C. Cir. 2018).
[22] *Chesapeake Climate Action Network*, 952 F.3d at 322.

conclusions received" during the comment period.[23] But EPA cannot claim that its new futility modeling is a logical outgrowth of the proposal, which contained no such modeling; therefore, commenters could not have anticipated the new modeling based on what was proposed. Nor can EPA lean on analyses submitted by commenters to establish that its own late modeling is a logical outgrowth.[24] The petitioners seeking reconsideration here had no timely notice of or opportunity to comment on analyses submitted by other commenters, nor on the Agency's own analysis performed only after the comment period and made public only with the Final Rule.[25] As EPA itself asserts in the Final Rule Response to Comments, "the public comment period is intended to offer an opportunity to respond to the issues raised in the Agency's proposal and supporting materials rather than to the content of other public comments."[26] Adequate notice requires instead that alterations in the Final Rule be something parties should have anticipated based on the proposal itself.

As clearly demonstrated throughout this petition, mandatory reconsideration would provide Petitioners the required period for public comment to critique the new modeling and analyses, and the new *de minimis* metrics, all of which are at the heart of the Final Rule's futility finding and related arguments. Accordingly, EPA is required to provide notice of and an opportunity to comment on its new modeling and consequent findings, and on the propositions in the Final Rule that rely on such modeling and findings. EPA must also provide an opportunity for comment on its new position that it cannot monetize ozone and $PM_{2.5}$ co-benefits associated with the vehicle GHG standards, as that position is fundamental to EPA's new conclusion that retaining the standards is unreasonable.

IV. THE FINAL RULE RELIES ON ENTIRELY NEW TECHNICAL ANALYSES TO SUPPORT ITS FUTILITY ARGUMENTS, AND SUCH TECHNICAL ANALYSES ARE FATALLY FLAWED.

EPA's futility rationales are premised on novel technical analysis of projected impacts of U.S. vehicle GHG emissions on Global Mean Surface Temperature (GMST) and Global Sea Level Rise (GSLR),[27] which we describe in this petition with shorthand such as global temperature and

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[23] 91 Fed. Reg. at 7691.

[24] *Small Refiner*, 705 F.2d at 547-549 ("As a general rule, EPA itself must *itself* provide notice of a regulatory proposal. Having failed to do so, it cannot bootstrap notice from a comment." (emphasis in original)).

[25] And even if the standard for evaluating whether EPA satisfied its statutory notice requirement included consideration of the content of public comments on the Agency's proposal (which it does not), EPA's new modeling is still not properly noticed because it provides for the first time modeled impacts on at least one metric, Global Sea Level Rise, that was not addressed by any commenter's modeling. EPA, Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act: Response to Comments ("RTC") at 217.

[26] RTC at 10.

[27] *See* 91 Fed. Reg. at 7728-34; EPA, Technical Memo on: Temperature, CO_2 Concentration, and Sea Level Rise Impacts of Greenhouse Gas Emissions from U.S. Motor Vehicles for the "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission

global sea level rise.[28] This new analysis incorporates numerous data, methodologies, models, assumptions, policy choices, factual findings, and other changes, which are new to the Final Rule.[29] Specifically, the Agency purports to calculate the changes in global temperature and sea level rise attributable to U.S. vehicle GHG emissions as percentages of total global anthropogenic impacts over specific time periods.[30] EPA also advances a so-called "illustrative" scenario that arbitrarily reduces modeled impacts by 50%.[31] Finally, EPA compares these percentages against three novel *de minimis* yardsticks : (i) the "range of measurability" of global temperature and sea level rise, (ii) global temperature "variability" from 2016-2025, and (iii) a 1% contribution threshold that EPA asserts courts have "consistently viewed" as *de minimis*.[32] The Agency then asserts that the impacts are so small as to be *de minimis* when measured against any of these yardsticks.

In section IV.A below, we demonstrate that EPA introduced the above analysis for the first time in the Final Rule—depriving the public of any notice and opportunity to comment on those issues—and that such analysis provides foundational technical support for the Agency's factual determinations as to futility.[33] We also explain that many objections raised in the comments remain relevant to the final futility analysis and provide context for the objections raised herein.

In sections IV-V, we advance three independent sets of objections of central relevance. Each of our objections reinforces the substantial likelihood that EPA's analysis and conclusions would have changed had the public been afforded the statutorily required notice and opportunity to comment on the differing inputs, assumptions, and methodologies presented in the final futility analysis. First, section IV.B shows that EPA's new modeling of U.S. vehicle emissions, global temperature, and global sea level rise is highly sensitive to modeling parameters, and EPA's choice of parameters is flawed in numerous ways. Section IV.C, in turn, presents modeling results addressing those flaws and showing significantly higher global temperature and sea level rise impacts attributable to U.S. vehicle GHG emissions. That section also illustrates the massive health and welfare impacts projected to result from the U.S. vehicle GHG emissions that EPA evaluated.

Second, section IV.D demonstrates that EPA's supposedly "illustrative" 50% scenario is actually critical to the Agency's futility finding. Without this arbitrary reduction, EPA's own model results would exceed even its stated 1% *de minimis* threshold. But even applying this reduction, the vast majority of modeled scenarios exceed the 1% *de minimis* threshold.

Third, section V explains that all of EPA's new *de minimis* thresholds are inappropriate for

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Standards Under the Clean Air Act" Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31105 ("EPA Temperature Memo").

[28] We also use as shorthand related terms such as "temperature," "global average temperature," "sea level," "average sea level rise," "global average sea level."

[29] In this section, we generally use the terms "analyses" and "analysis" to refer to some or all of these novel additions.

[30] 91 Fed. Reg. at 7728-32; *see generally* EPA Temperature Memo.

[31] 91 Fed. Reg. at 7732.

[32] 91 Fed. Reg. at 7732-33.

[33] The introduction of these materials in the Final Rule also violates section 307(d)(3)'s mandate that proposal include "the factual data on which the proposed rule is based" and "the methodology used in obtaining the data and in analyzing the data." CAA section 307(d)(3)(A)-(B).

assessing the materiality of reducing U.S. vehicle GHG emissions. Section V.A explains that EPA's new measurability and variability thresholds are conceptually irrelevant and numerically erroneous. Addressing the flaws in how EPA determined these thresholds as well as EPA's modeling of temperature and sea level impacts, we find that the impacts of U.S. vehicle GHGs exceed the thresholds, in some cases by more than an order of magnitude. Section V.B shows that EPA's 1% threshold has no basis in the caselaw and is arbitrary.

A. EPA relies on new technical analyses of climate change metrics not found in the proposal.

EPA's proposed repeal alleged that regulating GHG emissions of U.S. vehicles is futile because those emissions represent a small percentage of the global total and that reducing them in isolation would have no meaningful impact on climate change dangers. The proposal relied solely on the report of the Climate Working Group (CWG) to support this rationale.[34] Based on 2022 data, the proposal asserted that eliminating GHG emissions from light- and medium-duty vehicles would result in a 1.8% decrease in global GHG emissions, which allegedly correspond to "an approximate 3 percent reduction in predicted warming trends."[35] By contrast, EPA alleged that "[g]lobal warming trends from 1979 to 2023, the period with the best available data, were determined to a precision (or margin of error) of plus or minus 15 percent total. An estimated 3 percent reduction in global warming trends is well below the scientific threshold for measurability and is not a reliable measure for regulatory purposes."[36] EPA then made similar claims for heavy-duty vehicles, and all U.S. vehicles in the aggregate. EPA did not clearly explain what global warming trends it was concerned about with respect to futility, using differing formulations throughout the preamble such as "GHG emission concentrations or global warming potential,"[37] "GHG concentrations in the atmosphere or the rate of global climate change," or simply "[g]lobal warming trends."[38]

In the Final Rule, EPA still attempts to justify its rescission of the Endangerment Finding and all vehicle GHG emission standards based on futility. However, the Agency's methodology for determining that vehicle GHG emission standards are futile and its resulting futility finding are entirely new. In direct contrast to the proposal, EPA claims to no longer rely on the CWG report "for any aspect of [its] final action,"[39] following a federal court decision finding that the CWG report was secretly created in violation of the Federal Advisory Committee Act.[40] The Final Rule's futility

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[34] *See* Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards, 90 Fed. Reg. 36288, 36311-12 (proposed Aug. 1, 2025) (citing 2025 CWG Draft Report at 130).
[35] 90 Fed. Reg. at 36311.
[36] *Id.* Based on these factual allegations, EPA also proposed to find that there was no "requisite technology" under CAA section 202(a)(2), 90 Fed. Reg. at 36312, a basis which the Agency did not finalize.
[37] 90 Fed. Reg. at 36305.
[38] 90 Fed. Reg. at 36311.
[39] 91 Fed. Reg. at 7691 n.8.
[40] *See* Judgment, EDF v. Wright, No. 1:25-cv-12249-WGY, Doc. No. 99 (D. Mass., Jan. 30, 2026), https://library.edf.org/AssetLink/j0s1oj2lwi027ldk6y45xnnx3353t1y2.pdf. EPA's recent public statements, however, suggest that the conclusions of the CWG report continue to undergird the Agency's conclusions concerning the Endangerment Finding. *See* The Heartland Institute, *Lee Zeldin*

analysis also abandons the proposal's reliance on 2022 U.S. vehicle emissions data from the Inventory of U.S. Greenhouse Gas Emissions and Sinks.[41]

Instead, the Final Rule advances new modeling of vehicle emissions, global temperature, and global sea level rise, using four models (MOVES, OMEGA, FaIR, and BRICK) and an emissions scenario representing all U.S. vehicle CO_2 emissions beginning in MY2027.[42] While the proposed rule used MOVES and OMEGA modeling to estimate the regulatory impacts of the rule pursuant to Executive Order 12,866,[43] the Final Rule deploys these models for the entirely different purpose of supporting its futility rationale.[44] To that end, the Final Rule applies these models to a scenario involving *all* U.S. vehicle CO_2 emissions beginning in MY2027, as opposed to the repeal of certain emission standards.

The Final Rule also presents for the first time an "illustrative" scenario that reduces emissions, global temperature, and global sea level rise impacts by 50% from its modeled scenario. Further, EPA compares global temperature and sea level rise metrics to three new alleged *de minimis* thresholds: (i) the "range of measurability" for global temperature and level rise, (ii) global temperature "variability" from 2016-25, and (iii) a 1% *de minimis* threshold it claims has been recognized by courts. The Agency then claims *de minimis* impacts based on each of these

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defends 'controversial' record as head of EPA at Heartland Institute Climate Conference, YouTube (Apr. 8, 2026) https://www.youtube.com/watch?v=aZbsZi7Eybk (Administrator Zeldin making statements such as: "No longer are we going to rely on bad, flawed assumptions instead of accurate, present-day facts, without apology or regret." "You were right there on the front lines of advocating against there being an endangerment finding in 2009. You were there even going back further pushing back on predictions that you knew were not going to bear out." "They [the Obama administration] don't ever talk about what's good and necessary about carbon dioxide for the life of the planet….").

[41] 90 Fed. Reg. at 36311-12 .

[42] 91 Fed. Reg. at 7729. EPA also appears to have reversed course on the relevance of atmospheric GHG concentration impacts, which it had indicated were important in the proposal, *e.g.*, 90 Fed. Reg. at 36311 ("GHG concentrations in the atmosphere or the rate of global climate change"), while the Final Rule newly claims that "changes in . . . global concentrations are not the focus of the statutory standard for regulation in CAA section 202(a)(1)," 91 Fed. Reg. at 7732.

[43] *See* 90 Fed. Reg. at 36326-27; EPA, Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards Draft Regulatory Impact Analysis, Docket No. EPA-HQ-OAR-2025-0194-0086 ("DRIA").

[44] The Final Rule also separately applies MOVES and OMEGA to estimate the regulatory impacts of the rule pursuant to Executive Order 12,866, and that analysis is found in an entirely separate portion of the administrative record. *See, e.g.*, 91 Fed. Reg. at 7753-57; EPA, Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act: Regulatory Impact Analysis, Docket No. EPA-HQ-OAR-2025-0194-31090 ("RIA"); EPA, Updated modeling assumptions and tools for "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act" Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31054 ("EPA Modeling Memo"); EPA, Projected Criteria, Air Toxics, and GHG Emissions Impacts for the "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act" Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31055 ("EPA Emissions Memo").

comparisons. Finally, EPA's Final Rule appears to focus on CO_2 for the futility analysis, in contrast to the proposal's discussion of vehicular GHG emissions more broadly.[45]

Many aspects of the Final Rule's futility analysis—such as the sole reliance on global temperature and sea level rise impacts, the three new *de minimis* thresholds, the total vehicle emissions inventory, the 50% illustrative scenario, and the exclusive focus on CO_2 in lieu of other GHGs—were not found in the proposal. With respect to these issues, EPA's relevant factual data, methodology used in analyzing the data, and quantitative assumptions and determinations are all new to the Final Rule.[46] Therefore, it was impracticable for commenters to raise objections to such analyses during the public comment period.[47] Further, EPA relies on these technical analyses to justify its new futility finding and rationales, which the Agency claims are independent, severable grounds for its final actions, and which the Agency further describes as affirming other aspects of the rule.[48, 49] These analyses are also deeply flawed for multiple independent reasons shown below.

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[45] *See* 90 Fed. Reg. at 36312 ("Eliminating GHG Emissions From All Motor Vehicles Would Be Futile"); T. Sherwood, Vehicle Rule LD/MD/HD Physical Effects, Docket No. EPA-HQ-OAR-2025-0194-0047 (assessing both CO_2 and non-CO_2 GHG emissions of U.S. vehicles).

[46] While some commenters also adduced technical modeling regarding global temperature, comments themselves cannot give notice. Moreover, EPA's Final Rule does not purport to rely on the commenters' analysis, but it instead presents its own analyses.

[47] 42 U.S.C. § 7607(d)(7)(B).

[48] EPA also claims its futility finding supports its other legal rationales based on the statutory interpretation of section 202(a)(1) and the major questions doctrine. 91 Fed. Reg. at 7716–17 (the conclusion that "agencies have implied authority to exempt *de minimis* concerns . . . informs our interpretation of CAA section 202(a)(1) by suggesting that the provision does not encompass the attenuated chain of causation required to invoke the authority to regulate GHG emissions where regulations cannot have more than a trivial impact on the identified dangers to health and welfare"), 7710–11 ("the inability of GHG emission standards to have a material (i.e., non-*de minimis*) impact on the dangers attributed to global climate change in the Endangerment Finding informs our statutory interpretation"), 7724 (in its major questions doctrine discussion, asserting that "even eliminating all GHG emissions from all U.S. vehicles and engines would have only a *de minimis* impact on GMST and GLSR trends as a proxy for adverse health and welfare impacts" as discussed in the futility section). However, EPA's discussion in other parts of the rule seem to undermine its judgment as to futility. *See, e.g.*, RTC at 48 ("the absence of ongoing or certain harm is not the reason the Agency is concluding that CAA section 202(a)(1) does not authorize regulating GHGs in response to global climate change concerns").

[49] The Final Rule now also claims futility as an "independent" basis for rescinding the vehicle and engine standards for GHGs even if the Endangerment Finding is authorized under section 202(a). 91 Fed. Reg. at 7734. EPA's futility argument is supported by the new modeling that was made available after the comment period, which as described throughout this petition, required mandatory reconsideration. EPA also asserts that its separate repeal of the vehicle GHG emission standards as based on futility is informed by a cost consideration requirement under *Michigan v. EPA*, 576 U.S. 743 (2015). However, EPA in the Final Rule arbitrarily contradicts itself, stating that "while the EPA did consider costs, *the EPA does not base its decision here upon cost*, but on the primary rationales laid out in the preamble." RTC at 211. (emphasis added). Indeed, EPA failed to grapple with commenters' criticisms of its proposed conclusions regarding costs. Any objection to EPA's about-face regarding the applicability of cost considerations to repeal of the vehicle GHG standards, while claiming that

As such, our objections are of "central relevance to the outcome of the rule" and proper grounds for statutory reconsideration under CAA section 307(d)(7)(B).

At the same time, we note that the critiques advanced in this petition for reconsideration overlap with many critiques advanced in public comments.[50] The public comments remain relevant to the Final Rule's futility rationale and were raised with "reasonable specificity."[51] While such objections were sufficiently raised during the comment period, they relate to and support the objections raised in the present petition, so we reference them here for clarity. As discussed in section I, by filing this petition for reconsideration we do not concede that any of the objections herein were not raised with reasonable specificity during the public comment period.

Among other things, commenters demonstrated that EPA erred as a matter of law in conflating the statutory "contribut[ion]" analysis with whether a regulation has "measurable" impacts. The Act requires EPA to make an endangerment finding where emissions from a class of vehicles contributes to dangerous air pollution, without any prerequisite determination as to whether subsequent regulations would materially affect air pollution.[52] Commenters also presented technical modeling demonstrating that EPA's GHG standards have created and continue to create massive public health and welfare benefits of the kinds that Congress identified in the Act, including climate benefits valued up to $3.9 trillion,[53] alongside a wide range of other evidence showing significant benefits to health and welfare.[54] In addition, commenters presented arguments that EPA should not repeal existing vehicle GHG standards, which are reasonable and lawful, with enormous benefits that far outweigh costs.[55] Commenters further demonstrated why EPA's proposed method of comparing alleged impacts of U.S. vehicle GHG emissions on climate change trends with a so-called "scientific threshold for measurability" was legally and technically erroneous on numerous bases, including because EPA:

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its decisions in the Final Rule were not based on cost, could not practicably be raised during, and arose after the time for, the comment period. EPA's basis for its supposedly independent repeal of the vehicle GHG standards thus requires mandatory reconsideration.

[50] *See, e.g.,* Comment submitted by Environmental Defense Fund (EDF) et al., Docket No. EPA-HQ-OAR-2025-0194-3060 ("NGO Vehicles Comment"); Comment submitted by Natural Resources Defense Council (NRDC) et al., Docket No. EPA-HQ-OAR-2025-0194-2608 ("NGO EF Comment"); Comment submitted by The Institute for Policy Integrity at New York University School of Law et al., Docket No. EPA-HQ-OAR-2025-0194-3050 ("Joint SC-GHG Comment"). While our petition principally cites to certain comments filed by environmental and public health groups to demonstrate issues which were raised with reasonable specificity during the public comment period, we note that numerous other comments were made raising one or more of the critiques described in this discussion. *See, e.g.,* Comment submitted by Massachusetts Office of the Attorney General et al., Docket No. EPA-HQ-OAR-2025-0194-13587 ("States EF Comment"); Comment submitted by Attorney General of California et al., Docket No. EPA-HQ-OAR-2025-0194-2974 ("States Vehicles Comment").

[51] CAA section 307(d)(7)(B).

[52] *See, e.g.,* NGO Vehicles Comment at 86.

[53] *See, e.g., id.* at 16-18.

[54] *See, e.g., id.* at 91-189.

[55] *See, e.g., id.*

- Arbitrarily and without explanation considered only undefined climate change trends, while neglecting to consider more relevant metrics such as the damages to society caused by GHG emissions and the corresponding benefits of mitigating such emissions, consistent with EPA's longstanding practices;
- Arbitrarily and without explanation selected an irrelevant comparative climate measurability metric;
- Erroneously conflated measurability of climate change metrics with the materiality of reducing emissions;
- Ignored the cumulative and long-term nature of GHG emissions impacts; and
- Acted inconsistently with the Agency's approach to addressing criteria pollutants.[56]

Notwithstanding the Final Rule's novel technical methodology and analysis, it adopts analogous or the same reasoning as the proposal on these aspects of its futility rationales, such that the commenters' critiques continue to apply to the Final Rule. The balance of this section focuses on our objections to the Final Rule's new technical analysis.

B. EPA's new modeling of emissions, global temperature, and global sea level rise is arbitrary and capricious.

In this section, we raise several objections of central relevance to EPA's modeling of emissions and changes in global temperature and sea level rise. Each objection highlights the sensitivity of EPA's analysis to differing assumptions and methodologies, and the Agency's inexcusable failure to subject key elements of its technical analysis to statutorily required notice and comment.

First, EPA's sole reliance on its chosen metrics—the proportional contribution of U.S. vehicle GHG emissions to global average temperature and sea level rise—is an arbitrary way of measuring and valuing health and welfare harms from those emissions and of assessing the purported futility of the U.S. vehicle GHG standards. In fact, as EPA concedes, these intermediate metrics do not actually measure U.S. health and welfare harms at all. EPA cannot rationally rely on only these metrics to evaluate the futility of exercising its legal authority, and commenters criticized EPA's use of such metrics as proxies for assessing health and welfare harms in lieu of direct assessment of such harms.[57] We further detail these critiques to contextualize our objections to the Agency's new technical analysis.

Second, EPA arbitrarily selected 2027 as the baseline year for its modeling. By doing so, EPA's modeling incorporates all the emission reductions achieved by GHG emission standards over the prior 15 years—including the ongoing benefits of the emission reduction technologies those standards induced—while simultaneously claiming GHG standards do nothing meaningful. The modeling thus arbitrarily "bakes in" the powerful effects of the substantial reductions that GHG

[56] *See, e.g., id.* at 104-110.
[57] *See, e.g.,* RTC at 215 (noting that a "commenter stated that the EPA should utilize a different metric for consideration of futility that is not temperature change or sea-level rise"); Joint SC-GHG Comment at 5-6; NGO Vehicles Comment at 101-04; Comment submitted by Nathan Sweet et al., Docket No. EPA-HQ-OAR-2025-0194-1461.

standards thus far have achieved in both vehicle GHG emissions and in pollution-control technology costs. In circular fashion, EPA argues that the achievements of the standards make those standards futile.

Third, EPA arbitrarily assumes U.S. vehicle emissions will flatline after 2055, despite projections showing continued growth in vehicle miles traveled (VMT) through at least 2060. The Agency provides no basis for believing that VMT will stop growing or that vehicle GHG performance will improve sufficiently to offset increased travel absent regulation, especially as recent Administration actions actively undermine programs that promote cleaner vehicles.

Fourth, EPA's arbitrary selection of 2050 and 2100 as modeling endpoints significantly undervalues the climate impacts of U.S. vehicle GHG emissions in two ways: the proportional contribution of U.S. vehicles to global emissions is expected to grow from approximately 4% today to 10% by 2100 as other sectors decarbonize; and GHG emissions persist in the atmosphere for centuries, causing cumulative warming effects that extend well beyond 2100. Cherry-picking these endpoints significantly understates the impacts of U.S. vehicle GHGs on climate change.

Finally, EPA appeared to have arbitrarily counted only vehicle CO_2 emissions to the exclusion of non-CO_2 greenhouse gas emissions for purposes of its futility analysis. However, motor vehicles unquestionably emit non-CO_2 greenhouse gases as well, and EPA even models such non-CO_2 emissions in its Regulatory Impact Analysis (RIA) for the Final Rule. It has no basis to exclude those impacts from its modeling for the purpose of determining futility.

1. EPA's futility analysis solely considers the proportion of global average temperature and sea level changes caused by U.S. vehicle emissions, obscuring their enormous harms to American public health and welfare.

EPA states that under section 202(a) "the ultimate regulatory concern is impacts from air pollution on 'health or welfare.'"[58] Nonetheless, the Agency irrationally selects proportional global temperature and sea level rise changes as the exclusive metrics for evaluating futility. Both are metrics of the physical climate and do not directly represent health or welfare impacts. As EPA concedes in the preamble, these metrics "are not themselves the adverse impacts on health and welfare relevant for purposes of the analysis," and they "do not translate directly to adverse health and welfare impacts."[59] Thus, while global average surface temperatures and sea level rise are certainly relevant to climate change and may be reasonably considered in evaluating whether GHG pollution endangers health and welfare,[60] they are only intermediate metrics. EPA acted irrationally by considering *only* these intermediate metrics and by not considering the ultimate health and welfare impacts resulting from projected temperature and sea level increases, as well as other pathways by which GHG emissions harm health and welfare.[61] It is arbitrary and capricious to rely solely on

[58] 91 Fed. Reg. at 7732.
[59] *Id.*
[60] EPA does not appear to evaluate global temperature and sea level rise for this purpose in the Final Rule.
[61] For instance, as commenters described, vehicle GHG emissions have impacts on health and welfare that are not directly mediated by changes in temperature or sea level rise. Such changes

measures that "are not themselves the adverse impacts on health and welfare relevant for purposes of the analysis"[62] to claim that the program has "no meaningful impact on the identified dangers"[63] of climate change on health and welfare.[64]

EPA attempts to explain why relying on global temperature and sea level rise is superior to other physical impacts, but its argument is conclusory and unsupported. The Agency claims, without further explanation or citation, that other physical impacts—such as "hurricanes, floods, heat waves, ocean acidification, etc."—are "speculative, multi-faceted, and multi-causal."[65] As commenters explained, there is a scientific consensus that extreme weather events, such as hurricanes, floods, and heat waves, are becoming more frequent and intense due to climate change; and relatedly, increasing atmospheric CO_2 concentrations are also aggravating ocean acidification.[66] These metrics are more direct measures of public health and welfare impacts than the intermediate metrics of average global temperature or sea level increases. That is, as explained in comments, the American people and economy palpably and directly experience a hurricane hitting the Gulf Coast, a 100-year flood in Texas, a heat wave in the Pacific northwest, and a degradation of coral reefs and fisheries off the coast of Florida.[67] As such, EPA's cursory explanation for relying exclusively on global temperature and sea level rise in lieu of other physical, human health, and welfare factors in evaluating potential regulatory futility is arbitrary and unjustifiable.

Referring to its futility analysis, EPA further asserts that "the analytical difficulties, uncertainties, and multiple causal leaps involved in this exercise are themselves a reason to conclude that CAA section 202(a)(1) does not encompass emissions that can be said to lead to adverse health and welfare impacts only by constructing a global air pollution framework."[68] It is unclear what this line of argument means, as it appears to contradict the premise of the futility analysis itself.[69] To the extent EPA is reprising its proposed (but not finalized) scientific uncertainty rationale as an alternative basis for the Final Rule's conclusions on statutory authority, that is arbitrary and logically incoherent, as EPA simultaneously states that the Agency "is not relying on [any] new findings" of the health and welfare risks from GHG pollution,[70] and that "EPA does not adopt or rely on the proposed scientific alternative rationale" in its proposal."[71]

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include ocean acidification and direct CO_2 physiological effects on the nutritional value of crops. *See, e.g.,* NGO EF Comment 47-48, 141-50, 212-14.

[62] 91 Fed. Reg. at 7732.

[63] *Id.* at 7728.

[64] As our comments have already shown, this choice is doubly irrational given its divergence from the Agency's historical practice concerning metrics for evaluating the costs of GHG emissions and associated harms. *See* NGO EF Comment at 150-53; NGO Vehicles Comment at 102-03.

[65] 91 Fed. Reg. at 7732.

[66] *See generally* NGO EF Comment at 99-169.

[67] *See generally id.*

[68] 91 Fed. Reg. at 7732.

[69] *See id.* at 7729 (stating as the premise of its futility analysis that "the EPA is utilizing the climate modeling provided within this section to help illustrate that, even applying the assumptions of these climate models and uncertainties contained therein, that removing" U.S. vehicle GHG emissions would be futile).

[70] *Id.* at 7689 n.4.

[71] *Id.* at 7734; *see also id.* at 7734-38.

Even if global temperature and sea level rise were appropriate touchstones for evaluating the potential futility of vehicle GHG standards, the Agency's choice to focus on the impact of U.S. vehicles as a *proportion* of global anthropogenic impacts is independently arbitrary. Practically speaking, where the ultimate harm—like that of climate change—is catastrophic, even a tiny increment of harm can be highly meaningful and legally cognizable.[72] For example, while a 1% increase in the chance that you will pay a $100 parking ticket may be *de minimis*, a 1% increase in the chance that you will get cancer is certainly *not de minimis*.[73] Neither is a 1% decrease in the stock market, or a 1% decrease in the GDP.[74] And a 1% disparity between an architect's plans and a builder's product could very well be the difference between a functioning building and a heap of rubble. As commenters explained with extensive evidence, the absolute impacts of U.S. vehicle GHG emissions on the public health, the environment, and the economy are massive by any measure.[75] And even small increases in GHG emissions can cause material harms to public health and welfare,[76] particularly given the existence of feedback loops and "tipping points" at which even slight emission increases can generate large and irreversible harms.[77]

Moreover, EPA's sole reliance on measures of *average* global change in temperature or sea level is arbitrary because such impacts do not occur uniformly throughout the globe. As we detail in Appendix B, the continental U.S. has warmed 60% faster than the global average since 1970.[78] And many U.S. regions have warmed even faster, with arctic Alaska warming at three times the global

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[72] *See, e.g.*, Joint SC-GHG Comment at 6-7; *Citadel Sec. LLC v. SEC*, 45 F.4th 27, 36 (D.C. Cir. 2022) (observing that significance is context-dependent: "a one-second delay during a cruise across the Atlantic may be *de minimis*, but a one-second delay during a 100-yard dash is enormous"); *Ethyl Corp. v. EPA*, 541 F.2d 1, 18 (D.C. Cir. 1976) (en banc) ("[P]ublic health may properly be found endangered both by a lesser risk of a greater harm and by a greater risk of a lesser harm"); NGO EF Comment 49 n.54 (citing H.R. Rep. No. 95-294, at 50 (1977), *reprinted in* 1977 U.S.C.C.A.N. 1077, 1128).

[73] *See, e.g.,* CAA section 112(f)(2)(A), 42 U.S.C. § 7412(f)(2)(A) (requiring EPA to promulgate risk-based air toxics emissions standards where technology-based standards "do not reduce lifetime excess cancer risks to the individual most exposed to emissions from a source in the category or subcategory to less than one in one million").

[74] We critique EPA's 1% *de minimis* threshold further in section V.B below.

[75] *See* NGO EF Comment at 98-169; Joint SC-GHG Comment at 3-4; EDF Technical Comments at 64-108; *see also* National Academies of Sciences, Engineering, and Medicine, *Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare*, National Academies Press, 4-8 (2025), https://doi.org/10.17226/29239. Interagency commenters within the Federal government raised similar concerns. *See* Documentation of OMB/Interagency Review Under Executive Order 12866, Docket No. EPA-HQ-OAR-2025-0194-31104, Attach. 12715 2060-AW71 EF Vehicle Rule FRM Preamble EO 12866 To OMB 02032026 - RLSO at 140 ("Note also that a 1% effect is small relative to the total, but a 1% effect could entail a material change if the total is sufficiently large").

[76] *See, e.g.*, NGO Vehicles Comment at 107-08.

[77] *See* NGO EF Comment at 153; Joint SC-GHG Comment at 18-20.

[78] Kate Marvel et al., *Climate Trends*, *in* Fifth National Climate Assessment (Allison R. Crimmins et al eds., U.S. Glob. Change Research Program 2023), 2-4, https://toolkit.climate.gov/sites/default/files/2025-07/NCA5_Ch2_Climate-Trends.pdf.

average rate,[79] and Northeastern states such as Maine, New Jersey, and Rhode Island warming at nearly twice the global average.[80] Thus, EPA's projected global temperature impacts would likely be associated with greater impacts in those regions of the U.S.

Similarly, regions of the U.S. are experiencing far greater sea level rise than the global average. As commenters explained, continental U.S. sea level rise has significantly exceeded global average sea level rise over the past century.[81] Certain U.S. cities are experiencing even more rapid sea level rise. For example, Grand Isle, Louisiana, is currently experiencing a rise rate of 7.72 mm/year, while Rockport, Texas faces a rate of 6.71 mm/year—more than double the global mean of approximately 3.1 mm/year.[82] As with temperature, EPA's projected sea level rise impacts would likely be associated with greater impacts in these and other parts of the U.S. Even accepting the basic premise of EPA's futility framework, it would still be arbitrary to withdraw regulatory authority based on allegedly *de minimis* impacts on global averages when American cities and states would suffer greater and meaningful harms.

2. EPA arbitrarily selected 2027 as the baseline year for its modeling, relying on the emissions reductions benefits gained over the last decade-and-half of section 202(a) regulation to argue that such regulation is futile.

This critical modeling choice is arbitrary for two reasons. First, even assuming futility was a statutorily permissible basis for repealing the Endangerment Finding and GHG standards, the selection of 2027 as the baseline year is inconsistent with EPA's claim that the Agency lacks *any* statutory authority to regulate GHGs from vehicles. That is, to use futility as a basis for disclaiming all statutory authority to regulate GHGs, EPA would have to show that regulation *always* was and will be futile—including from the time of the 2009 Endangerment Finding—not merely starting with model year 2027. Second, the 2027 baseline year arbitrarily allows EPA to disregard and

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[79] T.J. Ballinger et al., NOAA, *Arctic Report Card 2025: Surface Air Temperature* 1 (Nov. 18, 2025), https://arctic.noaa.gov/report-card/report-card-2025/surface-air-temperature-2025/; M.L. Druckenmiller et al., NOAA, *Arctic Report Card 2025: Executive Summary* (Dec. 23, 2025), https://doi.org/10.25923/NRZF-J897.

[80] *See* Appendix B at 7 (collecting authorities); *see also* Environmental Law & Policy Center, *An Assessment of the Impacts of Climate Change on the Great Lakes*, 10 (2019), https://elpc.org/wp-content/uploads/2020/04/2019-ELPCPublication-Great-Lakes-Climate-Change-Report.pdf ("In the Great Lakes region, the U.S. states bordering the Great Lakes have seen an overall increase in annually averaged temperature of 1.4°F for the period 1985-2016 relative to 1901-1960, with the largest changes at the higher latitudes… For the extent of the Great Lakes Basin…, the temperature change is 1.6°F over this time period. These trends are higher than the overall change of 1.2°F over the contiguous United States (and found globally) for the trends over these time periods.").

[81] *See* NGO EF Comment at 210 (since 1900, regional relative sea level along the continental U.S. "rose on average by approximately 11 inches," compared to about 7 inches globally).

[82] John D. Boon et al., *Anthropocene Sea Level Change: A History of Recent Trends Observed in the U.S. East, Gulf, and West Coast Regions*, Va. Inst. of Marine Sci., Applied Marine Sci. and Ocean Eng'g, Spec. Rep. No. 467, at IV-2 (2018), https://scholarworks.wm.edu/entities/publication/fc099785-8ecc-47ec-9818-835ea9c8f19e; William V. Sweet et al., NOAA, *Global and regional sea level rise scenarios for the United States: Technical Report NOS.01* 7 (Feb. 2022), https://earth.gov/sealevel/us/resources/2022-sea-level-rise-technical-report/.

obscure a significant slice of the benefits of regulating vehicle GHG emissions: the model bakes in the powerful effects of the GHG program in reducing vehicle GHGs and emission-reduction technology costs over the last 15 years and going forward. EPA thus uses the benefits that have been already achieved under the GHG program to argue that the program does nothing meaningful. "[This] is like throwing away your umbrella in a rainstorm because you are not getting wet."[83]

First, EPA is not using this analysis to support a finding that prospective regulation (i.e., beginning with MY2027 vehicles) is no longer appropriate. Nor is EPA repealing only the prospective MY2027 and later GHG standards. Rather, the Agency is asserting that *any* past, present, or future vehicle GHG emission standards would be futile, that section 202(a) therefore provides no statutory authority to regulate GHGs at all, and consequently, that EPA must repeal the entire program, including all past and future standards and the 2009 Endangerment Finding.[84] But EPA cannot demonstrate that any and all GHG emission standards under section 202 are necessarily futile based only on modeling of the prospective impacts of regulating GHGs today, beginning in MY2027. Rather, even if futility were somehow a legitimate basis for withdrawing the Agency's statutory authority—and EPA fails to show that it is—the Agency would have to show that GHG regulation was futile *ab initio* and remained futile under all circumstances, including such circumstances as existed at the time of the 2009 Endangerment Finding itself. But EPA has not done so, or even purported to do so, instead selecting 2027 as its sole analytical baseline year, without analyzing any other scenarios.[85]

Second, it is circular for EPA to find that regulation could not materially affect health and welfare based on an analytical baseline that incorporates the emissions—and consequent health and welfare—benefits of the regulations that EPA now claims it lacked authority to issue. As EPA acknowledges, the GHG program has driven significant reductions in vehicle GHGs since its inception, including through the development of advanced internal combustion engine, hybrid, and zero-emission vehicle technologies.[86] For example, the EPA Automotive Trends report indicates a 23% decrease in average light-duty vehicle GHG emissions between 2009 and 2024.[87] Those technological developments and emissions reductions are reflected in MY2027 vehicles. Thus, by using 2027 as the analytic baseline, EPA tacitly (and wrongly) assumes that the considerable

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[83] *Shelby County v. Holder*, 570 U. S. 529, 590 (2013) (Ginsburg, J., dissenting).

[84] *See* 91 Fed. Reg. at 7691 (futility "supports the understanding that Congress did not design [section 202(a)(1)] to authorize or require the Administrator to prescribe standards in response to global climate change concerns"); 91 Fed. Reg. at 7688 (alleging that *de minimis* impacts mean that "regulation of GHG emissions falls outside the scope of air pollution problems Congress addressed when enacting CAA section 202(a)(1)").

[85] *Cf. United States v. Salerno*, 481 U.S. 739, 745 (1987) ("The fact that the Bail Reform Act might operate unconstitutionally under some conceivable set of circumstances is insufficient to render it wholly invalid, since we have not recognized an 'overbreadth' doctrine outside the limited context of the First Amendment.").

[86] *See, e.g.*, 91 Fed. Reg. at 7727; Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light Duty and Medium-Duty Vehicles, 89 Fed. Reg. 27896 (Apr. 18, 2024).

[87] *See* EPA, *The 2024 EPA Automotive Trends Report Greenhouse Gas Emissions, Fuel Economy, and Technology since 1975*, EPA-420-R-24-022 14 (Nov. 2024), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P101CUU6.pdf (showing a decrease in real-world fleet CO_2 emissions from 397g/mi in 2009 to 305g/mi in 2024).

improvements and emission reductions achieved by the GHG standards over the last 15 years would somehow have happened anyway, ignoring the substantially higher emissions and technology costs that likely would have been part of the baseline had EPA never exercised the regulatory authority that it now seeks to disclaim.[88]

In addition to shaping the current baseline, those regulatorily induced benefits will continue to be reflected in all vehicles made in later model years. That is, past GHG standards continue to spur ongoing emissions reductions.[89] EPA's own modeling assumes this, ranging from increasing adoption of electric vehicles over time, as well as greater uptake of advanced internal combustion engine technologies.[90] Given EPA's assertion that futility permits no regulatory authority at all, it should have assessed the impacts of a fleet whose GHG emissions were *never* regulated to begin with, not merely those of a fleet which has received the benefit of 15 years of protective GHG regulations.

3. EPA arbitrarily assumes U.S. vehicle emissions flatline after 2055.

EPA's modeling assumption that U.S. vehicle emissions flatline after 2055 is arbitrary. U.S. vehicle emissions in any given year depend largely on vehicle miles traveled (VMT) and fleet composition (i.e., the proportions of different vehicle technologies and their GHG performance). VMT is expected to increase over time. While fleet composition changes could improve the fleet's overall GHG emissions performance, it is also possible that overall GHG emissions could increase with rising VMT. Moreover, any such fleet-performance improvements would reflect the baked-in effects of the historical GHG regulatory program in spurring technological development and commercialization, and thus those improvements should not be considered in determining whether regulation is futile.

Beginning with VMT, as the U.S. population and economy grow, projections show greater demand for vehicle transportation. Consistent with this reasoning, EPA's MOVES model shows increasing VMT through 2060, which is the final year modeled by MOVES.[91] Similarly, the Federal Highway Administration projects ongoing annual growth in VMT up through the final year of its

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[88] EPA's earlier GHG rules projected significant emissions reductions above the baseline. *See, e.g.*, Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25328 (May 7, 2010).

[89] Future GHG emission standards would drive further improvements and preclude backsliding in progress toward reducing emissions. But even absent such emission standards, manufacturers are likely to retain some portion of the GHG performance improvements they have made over the past 15 years thanks to the GHG program.

[90] For example, the modeling files provided to Petitioners by the EPA Docket Center indicate that light-duty electric vehicle sales rise from 12% in 2027 to 31% in 2035 to 48% in 2055. *See* EPA Modeling Memo, Att. \LMHDV\A1\20251117_151129_a1.zip\20251117_151129_a1\ 20251117_151129_tech_shares.csv; EPA, Updated modeling assumptions and tools for "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act " Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31054.

[91] *See* Appendix A (discussing the increasing VMT projections in MOVES and the Annual Energy Outlook).

outlook, 2053.[92] The Final Rule provides no basis for believing that VMT will abruptly stop growing in 2055.

Absent improved GHG performance, increases in VMT directly correspond to increased emissions. EPA has not shown that, absent regulation, U.S. vehicle GHG performance will improve in 2055 and later years,[93] or that the quantum of such performance improvements will result in U.S. vehicle emissions flatlining notwithstanding VMT increases. By contrast, EPA's Final Rule and other recent Administration and congressional actions—such as the sunsetting of tax credits for lower-emitting technologies, weakening of the NHTSA fuel economy program, and nullification of preemption waivers for California's separate vehicle emission standards—are intended to halt programs that promote the manufacture and sale of cleaner vehicles.

4. EPA arbitrarily selected 2050 and 2100 as final years for its modeling, obscuring the full climate change harms caused by U.S. vehicle GHGs, which last long after 2100.

EPA models U.S. vehicle GHG impacts on global temperature and sea level rise as a proportion of global anthropogenic GHG impacts in 2050 and 2100. The Agency's choice to analyze only these two points in time is arbitrary, because they significantly undervalue the increasing and long-term adverse harms of climate pollution from U.S. vehicles in two critical ways. First, under EPA's framework, the proportional contribution of U.S. vehicles to global emissions is anticipated to increase over time; and second, GHG emissions accumulate in the atmosphere and continue to affect the physical climate for centuries and even millennia after their release.

EPA's own modeling shows that if the Agency stops controlling U.S. vehicular GHG emissions, the proportional contribution of those emissions to annual global totals will balloon over time, from approximately 4% of 2027 global CO_2 emissions today to 10% of 2100 emissions. Contrary to what EPA has claimed about U.S. vehicles being such a small slice of the total GHG emissions pie that they are not worthwhile to control, eliminating the GHG program is expected to dramatically *increase* the slice of the pie attributable to U.S. vehicles, even as other nations and sectors reduce their emissions. Moreover, 10% of global CO_2 emissions is by any account a significant portion of an air pollution problem—even without considering its global nature. Petitioners are not aware of, and EPA does not reference, any Agency precedent for determining that regulation of a category of air pollutant emissions that amounts to 10% of the total air pollution problem would have *de minimis* effects.

Second, EPA's failure to consider impacts after 2100 also ignores the long lasting and cumulative impacts of GHG emissions. The warming effect of a ton of GHGs emitted into the atmosphere today persists over very long timeframes. Significant portions of emitted CO_2 remain in the atmosphere for centuries and even millennia, generating a persistent physical climate response.

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[92] *See 2025 FHWA Forecasts of Vehicle Miles Traveled* (VMT) (Sept. 2025), https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm ("The Federal Highway Administration (FHWA) Spring 2025 long-term forecast of national vehicle miles traveled (VMT) projects total VMT increasing at an average annual rate of 0.6% between 2023 and 2053.").

[93] As explained above in the 2027 baseline year section, it is also not appropriate for EPA to account for these baked-in effects of the GHG program in determining whether or not the program is futile.

While other GHGs have different atmospheric lifetimes,[94] all result in climate responses that persist far beyond the year they are emitted. And U.S. vehicles produce emissions year after year, with annual emissions largely stacking on top of one another as they accumulate, similar to water that continues to be added into a bathtub slower than it drains. Modeling only impacts through 2100 arbitrarily ignores the persistent and cumulative impacts of U.S. vehicle GHGs on climate change that last beyond than 2100.

EPA's truncated modeling time-period contrasts sharply with how the Agency assesses the harm done by ozone-depleting chemicals and the benefits of curbing those chemicals. In 2020, EPA assessed those harms and benefits over a substantially longer time period in the context of stratospheric ozone protection. EPA's Atmospheric and Health Effects Framework Model (in use since the 1980s) "estimates the number of skin cancer and cataract cases and deaths from skin cancer in the United States that will be prevented by protecting the ozone layer" for people born in the U.S. from 1890 through 2100.[95] Persons born in 2100 may have a life expectancy of some 75 years (if not longer), meaning that the time-period for this EPA modeling should extend to at least 2175, encompassing most of the 22nd century. EPA has not provided any basis for adopting a more truncated time period in this rulemaking.

The above errors compound each other. Setting a cut-off date of 2100 for the modeling underweights the impact of latter years of higher proportional emissions (e.g., 10% of global CO_2 emissions in 2100), as well as the long-lasting and cumulative harms of GHG emissions beyond 2100. Both obscure the full impacts of vehicle GHGs on climate change. Extending the modeling period would more fully capture the effects of U.S. vehicle GHG emissions on global climate change concerns. EPA acted arbitrarily in cherry-picking the 2050 and 2100 endpoints without any explanation and outside the scrutiny of public comment. And as we quantitatively demonstrate in section IV.C, the selection of different endpoints leads to dramatically different conclusions.

5. EPA arbitrarily excluded vehicular emissions of nitrous oxide (N_2O), methane (CH_4), and hydrofluorocarbons (HFCs), from its analysis, even though motor vehicles unquestionably emit such gases.

In the 2009 Endangerment Finding, EPA determined that nitrous oxide, methane, and hydrofluorocarbons are among the GHGs that endanger human health and welfare, and concluded that emissions of those gases from motor vehicles contribute to that endangerment.[96] Indeed, a separate EPA technical memorandum on the impacts of the Final Rule models nitrous oxide and methane emissions, consistent with EPA's treatment of those pollutants in past vehicle GHG

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[94] *See* NASA, *Major Greenhouse Gas Sources, Lifespans, and Possible Added Heat* (June 22, 2023). https://science.nasa.gov/resource/graphic-major-greenhouse-gas-sources-lifespans-and-possible-added-heat/.

[95] EPA, *Atmospheric and Health Effects Framework Model Estimating Ultraviolet Radiation-induced Health Effects*, (Mar. 17, 2026), https://www.epa.gov/ozone-layer-protection/atmospheric-and-health-effects-framework-model-estimating-ultraviolet. The full report entitled *Updating the Atmospheric and Health Effects Framework Model: Stratospheric Ozone Protection and Health Benefits*, (May 2020), is posted at https://www.epa.gov/sites/default/files/2020-04/documents/2020_ahef_report.pdf.

[96] 91 Fed. Reg. at 7689 (citing 74 Fed. Reg. at 66516–17, 66536–37).

rules.[97] Yet the Agency's futility analysis arbitrarily ignores these greenhouse gases and models only the impacts of CO_2.[98]

EPA's exclusion of HFCs from its futility analysis is also unsupportable. HFCs, which are emitted from vehicle air-conditioner leakage, are climate super-pollutants, with a global warming potential hundreds or thousands of times higher than CO_2—in other words, one ton of HFC emissions has a vastly more powerful and immediate impact on climate change than one ton of CO_2. EPA appears to suggest that its futility analysis disregarded vehicle HFC emissions because there is "separately enacted legislation requiring a phase out of HFCs" under a different section of the Clean Air Act.[99] But as commenters explained, the relevant section of the Act, also known as the American Innovation and Manufacturing (AIM) Act of 2020, did not displace EPA's authority to regulate HFCs under section 202(a), and, in fact, the two statutory authorities complement each other.[100] The AIM Act therefore cannot justify the Final Rule's arbitrary disregard of any past, present, and future potential for HFC regulation under section 202(a). EPA has also previously analyzed and described the impacts of its section 202(a) regulations on HFC emissions.[101] And the Agency neglects to note that despite the regulation of certain motor vehicle air conditioners under the Technology Transitions Rule the Agency promulgated under the AIM Act of 2020, EPA's 2024 vehicle rule chose to retain an air conditioner leakage credit under its section 202(a) program to further drive down HFC emissions.[102] Moreover, the Technology Transitions Rule did not regulate air

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[97] *See* EPA Emissions Memo.

[98] *See* Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act, 91 Fed. Reg. at 7729-34 & tab.1-3 (Feb. 18, 2026). The relevant section of the Final Rule preamble exclusively discusses CO_2. The EPA Temperature Memo confusingly suggests the Agency did model nitrous oxide and methane as well, *see* EPA Temperature Memo 1-2, but it only appears to present results for CO_2, *see id.* at 4-6. We assume the Agency's presentations of exclusively CO_2 results in both the preamble and this technical memo supersede its suggestion that it may have also modeled nitrous oxide and methane for its futility analysis. To the extent the Agency did in fact model nitrous oxide and methane for its futility analysis, and simply chose to omit the results, such an omission is also arbitrary and capricious.

[99] 91 Fed. Reg. at 7729 n.172.

[100] NGO EF Comment (citing 89 Fed. Reg. at 27918).

[101] *See, e.g.*, EPA, NHTSA, *Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles: Regulatory Impact Analysis* (Aug. 2011), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100EG9C.PDF?Dockey=P100EG9C.pdf ("HD Phase 1 GHG RIA"); EPA, NHTSA, *Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles – Phase 2: Regulatory Impact Analysis* 5-34 (Aug. 2016), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100P7NS.PDF?Dockey=P100P7NS.pdf (last visited Apr. 9, 2026) ("HD Phase 2 GHG RIA"); EPA, *Final Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards: Regulatory Impact Analysis* (Aug. 2012), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100EZI1.PDF?Dockey=P100EZI1.pdf.

[102] Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles, 89 Fed. Reg. 27856 (Apr. 18, 2024) (". . . EPA is retaining small A/C refrigerant credits designed to incentivize the continued application of A/C refrigerant leakage mitigation countermeasures and the use of refrigerants with GWP lower than that required under the

conditioners in heavy-duty vehicles, and EPA is now eliminating the standards for those vehicles, which it previously had calculated as generating significant HFC emissions benefits.[103] There is no rational justification for excluding HFCs from the futility analysis.

C. Petitioners' modeling illustrates errors of central relevance in EPA's futility analysis.

Petitioners performed modeling to illustrate the severity of the errors infecting EPA's new futility analysis and how different methodological choices significantly affect EPA's findings and rationale. We begin by describing the methodology for the different emissions inputs and analytical timeframes in each of the three scenarios we modeled. We then present the results for U.S. vehicle emissions of CO_2, N_2O, and methane; and the contribution of U.S. vehicles to changes in atmospheric CO_2 concentrations, global temperature, and global sea level rise. A more detailed description of our methodology and results is in Appendix A.

1. Petitioners' modeling methodology

Besides the differences summarized below, petitioners' modeling generally followed EPA's methodology, including in the selection of the SSP2-4.5 baseline global emissions scenario, and the use of the same models as EPA: OMEGA, MOVES, FaIR, and BRICK. We modeled three scenarios, which we label A, B, and C:

- **Scenario A** ("EPA Emissions Inputs") assumes the same emissions inputs as EPA's modeling for the U.S. on-road sector.[104]
- **Scenario B** ("Today's Fleet") assumes that today's U.S. new vehicle fleet composition and per-vehicle emissions rates extend in perpetuity, with total emissions driven by VMT growth and fleet turnover. We use MY2025 to approximate today's fleet, as this is the most recent year with sufficiently reported data at the time we conducted our modeling. Consistent with the Trump Administration's rollbacks of key clean vehicle programs, this scenario shows a new vehicle fleet that does not become cleaner over time and

Technology Transitions Rule."); *see also* 89 Fed. Reg. at 28097 ("though not quantified, there is the potential that the final program could result in reductions of hydrofluorocarbon (HFC) emissions").

[103] *See, e.g.*, HD Phase 2 GHG RIA 5-34 ("The projected HFC emission reductions due to the A/C leakage standards are estimated to be 86,735 metric tons of CO_2eq in 2025, 256,061 metric tons of CO_2eq in 2040, and 314,930 metric tons CO_2 eq in 2050."); HD Phase 1 GHG RIA at 5-13 (estimating HFC reductions of 436,483 metric tons CO_2eq in calendar year 2030).

[104] The preamble describes these as scenarios #2 and #1 respectively. We do not separately present results for U.S. light and medium duty vehicles, and U.S. heavy duty vehicles (preamble scenarios #2a and #2b), as the Final Rule does not allege futility based on these scenarios. As discussed further in Appendix A and below, EPA did not disclose most of its emissions inputs, and Petitioners had to extrapolate some of the data points.

where electric vehicle adoption rates remain constant.[105] This scenario also recognizes that any future emissions improvements would be predicated on previous research, development, and learning catalyzed by the GHG program to date, and models the absence of such future emissions improvements in assessing whether the whole GHG program is futile, as discussed in section IV.B.2 regarding the selection of baseline year. Scenario B also corrects EPA's arbitrary choice to flatline emissions after 2055, as discussed in section IV.B.3, and its arbitrary choice to exclude nitrous oxide and methane emitted by motor vehicles, as discussed in section IV.B.5.

- **Scenario C** ("Pre-GHG Protection Fleet") assumes that U.S. new vehicle fleet composition and per-vehicle emissions rates as of approximately the time of the 2009 Endangerment Finding extend in perpetuity, with total emissions increasing proportionally to VMT.[106] This scenario addresses EPA's arbitrary choice to examine only one scenario with a 2027 baseline year. As we explained in section IV.B.2, even assuming that this kind of futility analysis is relevant to statutory authority to issue GHG standards, EPA would have to show that *any* such standards would be futile, not only a standard commencing with MY2027 and beyond. To illustrate the impact of selecting a different scenario that does not already bake in the emissions benefits of the GHG program to date, we chose to evaluate U.S. vehicle emissions roughly at the time of the 2009 Endangerment Finding itself, prior to EPA's adoption of protective GHG standards. Like Scenario B, Scenario C also corrects for flatlining emissions after 2055, as discussed in section IV.B.3, and the exclusion of nitrous oxide and methane emitted by motor vehicles, as discussed in section IV.B.5.

For all scenarios, we present results in 2050 and 2100, as does EPA, and also in 2200, which permits a fuller evaluation of the impacts of the Final Rule, illustrating the impacts of the errors described in IV.B.4 on EPA's futility analysis. In the limited time available, we were unable to model HFC emissions changes. However, as explained above, U.S. vehicles emit HFCs, and the GHG program has played a significant role in reducing HFC emissions, so a complete evaluation of the potential impacts of vehicle GHG regulation would require considering HFCs as well.

As explained in sections IV.A-B and our comments, we do not believe that EPA's futility analysis is relevant to whether the Clean Air Act requires EPA to make an endangerment finding. We also disagree with EPA's findings that vehicle GHG emission standards are futile, the methodology EPA used to reach those findings, and EPA's conclusion that retaining vehicle GHG standards is unreasonable. Our presentation of modeling results does not imply we agree with EPA's legal premises or the methodologies in the Final Rule. Nor do we mean for our modeling to represent the definitively correct ways to evaluate the futility of U.S. vehicle GHG regulation. Rather, our modeling demonstrates that—even assuming the basic framework of EPA's modeling approach—the results are highly sensitive to parameters such as the baseline year, the final year of

[105] While it is possible that vehicle manufacturers will backslide by manufacturing dirtier vehicles in the coming years compared to today's sales as a result of the Final Rule, we do not assume backsliding in this scenario, making it a conservative analysis.

[106] This scenario attempts to recreate the fleet composition from roughly the time following the Supreme Court's decision in *Massachusetts v. EPA*, 549 U.S. 497 (2007), and through the 2009 Endangerment Finding. As we explain further in Appendix A, we assessed several years of data for this scenario to mitigate short-term noise in the vehicle market data due to the Great Recession.

analysis, emissions inputs assumptions, and so forth. The mutability of the results further highlights the arbitrary nature of EPA's reliance on only one modeling scenario, calculated based on a single set of assumptions, and never subjected to public scrutiny through notice-and-comment, to determine that all vehicle GHG regulations—past, present, and future—are facially futile. In sum, our modeling results illustrate that, even assuming EPA's basic approach, the Agency's analysis and conclusions are severely flawed and EPA would likely reach different conclusions if the Agency reconsidered the issues raised in this petition.

2. Petitioners' modeling results

The balance of this section summarizes our modeling results. Tables 1-3 below present the contribution of U.S. on-road vehicles to emissions, and to changes in global CO_2 concentrations, global average surface temperature, and global sea level rise, for each of Scenarios A, B, and C. Scenarios A and B are presented relative to a 2027 baseline, consistent with EPA's approach. Scenario C, which evaluates the impacts of U.S. vehicle emissions had EPA never issued the 2009 Endangerment Finding or subsequent GHG regulations, is presented relative to a 2009 baseline.

Table 1. Scenario A: EPA Emissions Inputs – U.S. On-Road Vehicles Contribution

	2027	2050	2100	2200
Emissions (CO_2 MMT/yr)†	1,626	1,390	1,376	1,376
Median change in global CO_2 concentrations relative to 2027 (ppmv)	-	3.2 (4.5%)*	9.7 (5.9%)	22.5 (11.2%)
Median change in global surface temperature relative to 2027 (°C)	-	0.014 (2.4%)	0.045 (3.0%)	0.115 (5.8%)
Median change in global sea level rise relative to 2027 (cm)	-	0.07 (0.6%)	1.45 (1.9%)	6.39 (2.5%)

*The parentheticals indicate percentage of U.S. on-road vehicle contribution relative to total anthropogenic values since 2027.

† The emissions in this table are listed as CO_2 instead of CO_2e because we only modeled a change in CO_2 for Scenario A, consistent with EPA's emission inputs.

Table 2. Scenario B: Today's Fleet Composition – U.S. On-Road Vehicles Contribution

	2027	2050	2100	2200
Emissions (CO_2e MMT/yr)	1,553	1,495	1,978	2,818
Median change in global CO_2 concentrations relative to 2027 (ppmv)	-	3.1 (4.4%)*	11.4 (6.9%)	33.3 (16.6%)
Median change in global surface temperature relative to 2027 (°C)	-	0.014 (2.4%)	0.053 (3.6%)	0.170 (8.6%)
Median change in global sea level rise relative to 2027 (cm)	-	0.07 (0.6%)	1.61 (2.1%)	8.32 (3.3%)

*The parentheticals indicate percentage of U.S. on-road vehicle contribution relative to total anthropogenic values since 2027.

Table 3. Scenario C: Pre-GHG Protection Fleet Composition – U.S. On-Road Vehicles Contribution

	2009	2027	2050	2100	2200
Emissions (CO_2e MMT/yr)	1,743	2,085	2,250	2,901	4,144
Median change in global CO_2 concentrations relative to 2009 (ppmv)	-	3.1 (6.4%)*	7.3 (6.2%)	19.5 (9.1%)	51.4 (20.7%)
Median change in global surface temperature relative to 2009 (°C)	-	0.015 (2.7%)	0.036 (3.2%)	0.094 (4.7%)	0.269 (10.7%)
Median change in global sea level rise relative to 2009 (cm)	-	0.04 (0.72%)	0.29 (1.7%)	3.57 (4.4%)	14.37 (5.5%)

*The parentheticals indicate percentage of U.S. on-road vehicle contribution relative to total anthropogenic values since 2009.

Petitioners' modeling results demonstrate several things. First, EPA failed to adequately document its data and methodology, rendering its results not reproducible by the public and violating both the legal requirements of CAA section 307(d) and prevailing scientific norms. Specifically, although Scenario A is meant to reproduce EPA's modeling through 2100, Petitioners were unable to reproduce EPA's projected global temperature and sea level impacts because the Agency hid from the public much of what it did. For example, although EPA purported to project temperatures based on emissions from 2027-2100, EPA only revealed the emissions inputs for 4% of those years, requiring the public to figure out what the Agency used for the remaining 96% of emissions inputs. Furthermore, although EPA purported to run four models—OMEGA, MOVES5, FaIR, and BRICK—the Agency only disclosed crucial modeling files for just one of the four models (OMEGA), leaving the public to try to recreate how EPA ran the remaining three models.[107] EPA also did not disclose many of the key parameters that would have enabled Petitioners to reproduce EPA's model runs. For example, although each model gets version upgrades as science improves (just like phones and computers get upgrades), EPA did not disclose the model version of BRICK that it used.

Assuming that EPA in fact ran the models as it claims, all such data and modeling files were unquestionably within its possession. But the Agency hid this critical information from the public, making it infeasible for the public to truly know what the Agency did or to precisely reproduce the Agency's results for purposes of public critique. Notwithstanding the Agency's severe procedural failures, Petitioners' scientific and technical experts were able to reproduce results similar to and consistent with the Agency's findings, and we believe that comparing the results in Scenarios A-C reasonably illustrates EPA's failure to adequately account for the climate change impacts of U.S. vehicle GHGs and the arbitrary nature of EPA's reliance on only one modeling scenario.[108]

Second, the results quantitatively demonstrate Petitioners' arguments above: that the projected emissions, temperature impacts, and sea level impacts are highly sensitive to starting assumptions and methodologies. This reinforces both the gravity of EPA's procedural error in not

[107] While EPA did provide MOVES5.R1 and MOVES5.R2 modeling files upon Petitioners' request to the EPA Docket Center, the outputs from these provided files do not match EPA's stated emission values in its futility analysis.

[108] *See* Appendix A (explaining Petitioners' methodology).

providing the public with notice and opportunity to comment on these key data and methodological assumptions, as well as the substantive arbitrariness of EPA's determinations. For example, considering Scenario A (EPA Emissions Inputs), projected global temperature impacts more than double from 0.045 °C in 2100 to 0.115 °C in 2200, while sea level impacts more than triple from 1.45 cm in 2100 to 6.39 cm in 2200.[109] The impacts balloon even further in Scenario C, which evaluates a vehicle fleet composition from the era prior to EPA GHG regulation: had EPA never regulated U.S. vehicle GHGs, climate emissions from U.S. vehicles could have elevated temperatures by 0.269 °C and sea level by 14.37 cm by 2200.

Third, these impacts are grave. For instance, a projected temperature increase of 0.269 °C is just shy of half a degree Fahrenheit (0.484 °F). This exceeds the total warming caused by all human activities across the globe over the last decade,[110] and approximates one-quarter of all global warming since the start of the Industrial Revolution.[111] Similarly, the projected sea level rise of 14.37 cm by 2200 is equal to 5.66 inches, or nearly half a foot of sea level rise. This is more than three-quarters the total global sea level rise since 1900.[112] To put this in context, studies suggest that even an increase of as little as 10 cm in sea level rise could *double* flooding frequency in major U.S. cities, such as Seattle, San Francisco, and Los Angeles.[113] It bears remembering that this represents potential impacts from just *one* portion of *one* sector from *one* country—the U.S. on-road transportation sector—yet the resulting harms to our global climate are staggering. Far from *de minimis* impacts, EPA's rescission of its section 202(a) GHG authority threatens to turn the U.S. vehicles sector into the single largest source of climate pollution in the whole world.

Fourth, as explained already in Section IV.B.1, many American communities will bear far greater impacts than suggested by these global average figures. Global average temperature increases are not distributed evenly across space, with, for example, Arctic Alaska warming at three times the global average rate and some Northeastern states warming at nearly twice the global average.[114] A region that warms three times the above-described 0.269 °C projection would warm by 0.807 °C, or nearly 1.5 degrees Fahrenheit (1.453 °F), a palpable difference. The same is true for sea level rise, and some U.S. cities have experienced sea level rise at over twice the global average.[115] Modeling of

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[109] As explained above, these numbers are consistent with and similar to the Agency's model results, but not exactly the same given EPA's lack of transparency in its analysis.

[110] Robert Rohde, Global Temperature Report for 2025, Berkeley Earth (Jan. 14, 2026), https://berkeleyearth.org/global-temperature-report-for-2025/ ("Since 1980, the overall trend has been about +0.20 °C/decade (+0.36 °F/decade).").

[111] *See* NGO EF Comment at 100 ("The observational record as of 2020 shows an increase of approximately 1°C in global average temperature since the period 1850-1900 (when industrial activity started) . . . .").

[112] *See* NGO EF Comment at 210 ("Global mean sea level has risen about 7 inches (approximately 18 centimeters) since 1900, up from 6.7 inches reported in EPA (2009)."") (quoting NASEM 2025 Climate Report).

[113] *See* Appendix B at 11 (citing Sean Vitousek et al., *Doubling of coastal flooding frequency within decades due to sea-level rise*, 7 Sci. Rep. 1399 (2017), https://doi.org/10.1038/s41598-017-01362-7, and concluding that "[t]his research highlights how even 10 cm of SLR doubles flooding potential along the west coast of the US, including Seattle, San Francisco and Los Angeles").

[114] *See* Appendix B.

[115] *See* Appendix B.

local sea level rise along the U.S. coast of the Gulf of Mexico demonstrates that the Gulf is projected to suffer substantially greater local sea level rise impacts than the global average. For example, assuming EPA's emissions inputs (Scenario A), we project that the impact of U.S. vehicle emissions on local sea level rise in the Gulf could reach 3.7 cm by 2100, far exceeding the global average impact of 1.45 cm.[116] By 2200, we find that the impact on Gulf local sea level rise could rise up to 55.5 cm, in a scenario where EPA never regulated vehicle GHGs (Scenario C). This is equivalent to 21.9 inches, or over 1.5 feet—a truly staggering amount of sea level rise. Further, even apparently "small" global average temperature increases can yield severe increases in the intensity and frequency of extreme weather, such as hurricanes, droughts, rainfall, heatwaves, wildfires, and floods, with devastating impacts for human health and welfare.[117] And vulnerable populations, such as economically and socially disadvantaged communities and Indigenous or minority populations, are especially vulnerable to climate change.[118]

Finally, to monetize the harms of U.S. vehicle GHG emissions, Petitioners also evaluated the social costs of GHGs (SC-GHG). In response to the proposal, commenters already presented overwhelming evidence that EPA's proposed repeal would cause massive health and welfare harms quantifiable through SC-GHG.[119] Petitioners calculated SC-GHG assuming the Final Rule's methodology of projecting emissions, global temperature, and sea level impacts to further illustrate the massive health and welfare harms caused by U.S. vehicle GHG emissions. As detailed in Appendix A, we project that EPA's estimated level of U.S. vehicle GHGs will cause $17.6 *trillion* in global climate change damages through 2100.[120] Addressing the errors in EPA's modeling as explained earlier in section IV, these damages increase to as much as $38.9 trillion by 2200, in a scenario where EPA never regulated vehicle GHG emissions.[121] For context, the entire U.S. economy's Gross Domestic Product in 2024 was $28.75 trillion.[122] Thus, through 2200, U.S. vehicle GHG emissions could cause damages to society exceeding the annual economic output of the entire United States. Obviously, this is massive harm.[123]

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[116] *See* Appendix D. Due to the specifications of our local sea level rise model, our modeling of Gulf of Mexico local sea level rise is relative to a 2030 baseline, such that these projected impacts occur over a shorter timeframe than the global sea level rise, which we modeled relative to a 2027 baseline for Scenario A and relative to a 2009 baseline for Scenario C. Were we to model Gulf of Mexico local sea level rise relative to a 2027 or 2009 baseline, we would likely project even greater impacts.
[117] *See* Section IV.B.1 and Appendix B.
[118] *See* NGO Vehicles Comment at 159-61.
[119] *See, e.g.*, NGO Vehicles Comment.
[120] As we explain in Appendix A, this calculation is based on Scenario A (EPA Emissions Inputs), EPA's 2023 updated approach to calculating social costs of GHGs (SC-GHG), and a 2% discount rate.
[121] *See* Appendix A. This presents results for Scenario C applying the SC-GHG methodology at a 2% discount rate.
[122] World Bank Group, *GDP (current US$) - United States*, https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=US (last accessed Apr. 14, 2026).
[123] These figures do not account for other sources of harm associated with fewer clean vehicles, such as criteria pollutant damages, lost consumer fuel savings, energy security harms, and more.

D. EPA's "illustrative" 50% scenario is arbitrary and capricious.

The Final Rule posits an "illustrative" 50% reduction scenario where the Agency arbitrarily reduces the global temperature and sea level rise impacts by 50%.[124] Although EPA putatively presents this scenario for "illustrative" purposes only, and only in the preamble text without any technical documentation, the Agency's futility finding relies critically on it. Notably, EPA claims that "courts have consistently viewed impacts of 1% as *de minimis*"[125] (an erroneous assertion we further critique in section V.B below). The Agency's actual modeling of the impacts of U.S. vehicle GHG emissions on global temperature and sea level rise—without the 50% reduction—shows the impacts are approximately 3% for global temperature and 2% for global sea level rise, both of which exceed EPA's stated 1% threshold. Only by applying this so-called "illustrative" scenario does EPA then claim that the potential impacts of regulation are "approximately 1% of the model-projected change in global temperature for 2050 and 2100" and "much less than 1% of the change in global sea level rise modeled for 2050 and 2100."[126] Thus, far from being merely "illustrative," EPA's scenario is the critical linchpin of its futility finding—without this arbitrary 50% reduction, even EPA's own numbers would defeat its *de minimis* argument at the Agency's own threshold. This scenario is fatally flawed, both in its arbitrary selection of a 50% reduction and in its seemingly back-of-the-napkin methodology for estimating global temperature and sea level rise. The lower contribution numbers derived from the illustrative methodology, moreover, compound the flaws made in EPA's original modeling of all U.S. vehicle emissions; corrections to that modeling produce significantly greater contributions, even after applying a 50% reduction.

First, EPA's 50% emissions reduction is irrational. The Agency claims that reducing the total impacts of the U.S. vehicle sector is appropriate given the time required for fleet turnover and given that the reductions required by the latest tranche of vehicle GHG emission standards adopted in 2024 (i.e., MY2027 and later standards) are approximately 50% of those achieved under the preexisting GHG standards (for MY2026). The Agency then alleges that the appropriate reduction for a "likely real-world scenario" "turns on a variety of factors that are difficult to predict, including our regulatory decisions for MY 2032 and beyond, separate regulatory influences, and changes to the underlying economics, technologies, and consumer preferences."[127] EPA further opines that the illustrative scenario does not "reflect what [GHG] standards would realistically achieve given technical and statutory constraints" and thus is "likely an overestimation" of actual impact.[128]

None of these rationales sufficiently explain a 50% reduction, and they only further demonstrate the fundamental conceptual flaws in EPA's methodology. As we explained in section IV.B.4, the presence of fleet turnover means that the modeling is sensitive to the analytical timeframe, such that a longer timeframe more accurately captures the full impacts of U.S. vehicle GHGs, and EPA acted arbitrarily in only considering 2050 and 2100 endpoints. Moreover, there are well-established methodologies for calculating the rate of fleet turnover, including the methodologies applied by EPA in its MOVES model. Applying those methodologies, we can quantify the emissions attributable to new MY2027 and later vehicles in any given year, which we

[124] 91 Fed. Reg. at 7732.
[125] *Id.* at 7733. EPA's 1% *de minimis* threshold is also arbitrary, as we explain in section V.B.
[126] *Id.*
[127] *Id.* at 7732.
[128] *Id.*

present below and detail in Appendix A.

Table 4. Scenario A: EPA Emissions Inputs – Proportion of Cumulative CO_2 Emissions Attributable to New MY2027 and Later Vehicles by Year (%)

Year	Proportion
2050	61%
2100	87%
2150	92%
2200	94%

Table 4 shows that by 2050, the cumulative CO_2 emissions from MY2027 and later vehicles are already 61% of the total on-road vehicle emissions through that year. This number grows over time, reaching over 87% by 2100 and 94% by 2200. These numbers far exceed EPA's 50%.

The Agency's second rationale for the 50% reduction is that the 2024 rules established standards that phased-in through MY2032, and that those standards approximate a 50% reduction from the preexisting standards for MY2026.[129] While the efficacy of the 2024 rules relative to the prior GHG rule baseline may be relevant to determining the reasonableness of the 2024 rules themselves, there is no reason for using an approximation of this value to evaluate whether GHG regulation generally would be futile. As we explained in section IV.B, EPA is not merely determining that a prospective regulation of GHGs that requires a 50% emissions reduction is unreasonable. It instead uses this analysis to justify that any past, present, or future section 202(a) GHG emissions standards would be futile, and to repeal all existing GHG rules.

Moreover, it is illogical to treat the MY2026 standards as the baseline because the Agency is repealing those very standards in this rule. The same applies to treating any earlier standard as the baseline. Rather, an appropriate baseline would be *the complete absence* of any GHG regulation, both now and in the past, since EPA is eliminating all such GHG regulations and disclaiming authority to issue any such regulations in the future based on the purported "futility" of that regulatory scheme.[130] Moreover, the reductions achievable by the 2024 rules are unlikely to be the maximum reductions achievable over the course of the GHG program. Just as the Agency has developed increasingly more protective standards over the past 15 years based on evolving pollution control technologies, a future Administrator could set more protective standards than the 2024 rules.

EPA's 50% reduction thus reflects (imprecisely) specific prior regulatory choices based on facts that existed at those times, not any inherent limitation on statutory authority. A future Administrator might reasonably project greater emission reductions as technology advances, consistent with EPA's historical exercise of section 202(a) to achieve greater than 99% reductions of

[129] The Agency also explains that the standards for each vehicle category vary, for example with 50% CO_2 reduction projected for LD vehicles, 41% for MD vehicles, and 25-60% for HD vehicles depending on subcategory. *See* 91 Fed. Reg. at 7732 & n.180.

[130] As we explained above in section IV.C, our Scenario C is one way to assess this.

certain pollutants.[131] The quantum of emission reductions driven by a future GHG standard would continue to depend on relevant facts—such as technological feasibility, costs, consumer choice, infrastructure availability, and so forth. EPA's Final Rule disclaims all authority to establish GHG standards on the theory that standards are futile under any circumstance, meaning that the Agency must contend with the impacts of doing just that, not merely a crude approximation of the impacts of the 2024 rules.

The Agency's methodology for deriving global temperature and sea level rise impacts under this illustrative scenario is also arbitrary. Indeed, it is unclear what analysis the Agency has even performed. EPA's technical memorandum on global temperature and sea level rise modeling does not discuss the illustrative scenario.[132] The emissions inputs for this scenario are nowhere to be found—for example, it is unclear if the Agency meant to model a 50% emissions reduction in each year beginning in MY2027, or if those emissions reductions are weighted more in later years consistent with its fleet turnover rationale.[133] And it appears the Agency did not perform global temperature or global sea level rise modeling for this scenario at all; instead, it merely multiplied the modeled global temperature and sea level rise outputs for the original scenario (of eliminating all U.S. vehicle emissions) by 50%. But as EPA's own preamble explains, global temperature and sea level rise impacts are the product of highly complex physical climate processes that the Agency's chosen models emulate.[134] So even assuming a 50% emissions reduction scenario would be appropriate as an input to the BRICK and FaIR models, it is arbitrary to just scale modeled outputs for a different emissions scenario by 50%. EPA cannot reasonably claim those values represent the impacts of vehicle GHG regulation on global temperature and sea level rise. There is no justification for substituting the sophisticated modeling tools EPA is using in the same section of the Final Rule with an exogenous, back-of-the-napkin guess that conveniently produces the very result that EPA is aiming to manufacture.

EPA's cursory justification of its methodology is baseless. The Agency admits that using the illustrative scenario to examine global temperature and sea level rise impacts "pairs some analytic tools not intended for this purpose with other tools in the literature" and "cannot be assumed to translate with precision directly to specific adverse health or welfare impacts."[135] In plain English, that means the illustrative results were produced by a method not intended for this purpose and do not actually mean the thing the Agency wants them to mean. That is, the results are wrong.

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[131] *See* 89 Fed. Reg. at 27893-95. The statute, moreover, contemplates not merely the "control" of emissions but their "prevent[ion]," 42 U.S.C. § 7521(a)(1), "that is, the reduction or elimination, through any measures, of the amount of pollutants produced or created at the source," *id.* § 7401(a)(3).

[132] *See* EPA Temperature Memo.

[133] As explained in section IV.B.4, the timing of emissions significantly affects their contribution to physical climate changes.

[134] *See* 91 Fed. Reg. at 7729 (explaining how FaIR models the complex physical processes and uncertainties associated with climate change, including "atmospheric and ocean temperatures and emissions of other gases," "radiative forcing from greenhouse gases, aerosols, albedo changes due to land use, solar cycles, and volcanic eruptions," "the sensitivity of climate to increases in atmospheric CO2 concentrations, forcing from aerosol interactions with radiation and clouds, forcing from black carbon on snow, and carbon cycle parameters"); *id.* (analogous explanation for BRICK).

[135] 91 Fed. Reg. at 7732.

Finally, the low contribution numbers in EPA's illustrative scenario are the product of compounding errors with its original modeling. In Table 5, we show global temperature and sea level impacts reduced by 50% for each of the three scenarios we modeled, in 2100 and 2200.[136]

Table 5. All Scenarios – 50% Reduction of Global Temperature and Sea Level Rise Changes, in 2100 and 2200, Absolute Values and Percentages Relative to Baseline SSP2-4.5

	2100	2150	2200	2100	2150	2200
Global Mean Surface Temperature	Absolute values (°C)			Percentages*		
Scenario A: EPA Emissions	0.023	0.040	0.058	1.52%	2.21%	2.91%
Scenario B: Today's Fleet	0.027	0.053	0.085	1.79%	2.94%	4.30%
Scenario C: Pre-GHG Protection Fleet	0.047	0.086	0.135	2.33%	3.73%	5.35%
Global Sea Level Rise	Absolute values (cm)			Percentages*		
Scenario A: EPA Emissions	0.73	1.81	3.20	0.95%	1.10%	1.26%
Scenario B: Today's Fleet	0.81	2.14	4.16	1.06%	1.30%	1.65%
Scenario C: Pre-GHG Protection Fleet	1.79	4.13	7.19	2.20%	2.45%	2.75%

*Percentages for Scenarios A and B are compared against the SSP2-4.5 increase in temperature relative to 2027. For Scenario C, the percentages are calculated against the SSP2-4.5 increase in temperature relative to 2009. Those values are included in Appendix A.

As with our modeled results presented in section IV.C, the 50% reduction values are highly sensitive to the different methodological assumptions and parameters, none of which EPA subjected to notice-and-comment. The resulting percentage contributions to temperature and sea level changes in 2100 and later years exceed EPA's alleged 1% threshold in all cases except one: EPA emissions Scenario A for global sea level rise in 2100, which falls just shy of 1% (0.95%). However, even assuming EPA's emissions inputs, a 50%-reduced contribution of U.S. vehicles to temperature changes exceeds 1% (1.52%) in that same year, and the 50%-reduced contribution to both temperature and sea level rise changes also exceeds 1% by 2150. We note, moreover, that EPA's own modeling actually shows 50%-reduced contribution exceeding 1% in 2100 for both temperature and sea level rise.[137] Of course, the actual modeled impacts (absent EPA's arbitrary 50% reduction)

[136] Consistent with the text, our presentation of these 50% reduction values does not imply our support for EPA's methodology here: it is clearly wrong to simply reduce modeled temperature and sea level rise impacts by 50%. We are only presenting these 50% reduction values to demonstrate that even following EPA's general methodology, the results generally exceed the Agency's preferred 1% *de minimis* threshold.

[137] Specifically, EPA reports a temperature change of 0.019 °C in 2100, relative to a 1.28 °C baseline, and a sea level rise of 0.7 cm in 2100, relative to a 69.5 cm baseline. These equate to 1.48% and 1.01% respectively, such that both figures exceed 1%. As we explained in section IV.C, we were unable to reproduce EPA's exact values given the Agency's lack of transparency in documenting the analysis that it performed. Nonetheless, EPA's own values further reinforce that the impacts are not *de minimis*.

significantly exceed 1% in 2100 and later years.[138]

Further, certain scenarios show results much greater than 1%. For example, if EPA had never regulated vehicle GHGs (Scenario C), the 50%-reduced temperature impacts attributable to U.S. vehicle GHGs could rise to as high as 5.35% by 2200. This is over five times higher than EPA's supposed 1% threshold. Even assuming EPA's methodology, this is obviously not *de minimis*.

V. EPA'S NEW *DE MINIMIS* COMPARISON METRICS ARE ARBITRARY AND CAPRICIOUS.

EPA's Final Rule advances three new metrics against which it compares the impacts of U.S. vehicle emissions, none of which the public had an opportunity to comment on: (i) the "range of measurability" for global temperature and sea level rise, (ii) global temperature "variability" from 2016-25, and (iii) a 1% *de minimis* threshold it claims has been recognized by courts. Section V.A demonstrates that EPA's comparisons between U.S. vehicle impacts with its first two "measurability" and "variability" metrics are fundamentally flawed and conflate distinct technical concepts. Further, EPA's calculated or cited numbers (and in at least one case, the failure to cite any number) for these comparative metrics are erroneous. Adjusting for these errors results in far smaller variability and measurement uncertainty numbers, such that EPA's projected U.S. vehicle GHG impacts on global temperature and sea level rise exceed the relevant variability and measurement metrics. For example, EPA's projected 2100 global sea level rise impact of 1.4 cm is *3.5 times* the 0.4 cm global sea level rise measurement uncertainty reported by NASA. When we address both the modeling errors and the variability and measurement uncertainty errors, we identify impacts that far exceed the comparators, including by more than an order of magnitude. Thus, even hypothetically assuming the propriety of EPA's methodology, the agency erred in determining that U.S. vehicle impacts were *de minimis*. Section V.B demonstrates that the third comparative metric, the 1% threshold, and EPA's process for deriving that metric are arbitrary and inconsistent with precedent.

A. EPA's new measurability and variability metrics are arbitrary.

We begin with our conceptual critiques of EPA's "measurability" and "variability" metrics, which suffer from similar flaws as identified in our comments.[139] It is not entirely clear what EPA means by these terms, which it describes using various related but distinct terms, such as:

- "the standard margin of error,"[140]
- "the accepted variability in GMST and GSLR measurement,"[141]
- "the range of inherent variability in measurement for trends in GMST and GSLR,"[142]

[138] See section IV.C.
[139] *See* NGO Vehicles Comment at 104-10.
[140] 91 Fed. Reg. at 7688.
[141] *Id.* at 7691.
[142] *Id.* at 7711.

- "the range of measurability,"[143]
- "variability,"[144] and
- "a measurable, material impact on trends in global temperature or sea level."[145]

EPA fails to detail its methodology for deriving or defining any of these comparative metrics, so it is not clear what they represent. The preamble does report two sets of numerical values. It claims that "GMST variability from 2016–2025 was 0.14 °C" based on a NOAA website.[146] In a footnote, it also claims that a separate NOAA website "estimate[es] uncertainty in annual global mean surface temperature of approximately ±0.05 °C since 1950, increasing to ±0.1–0.2 °C in the late 19th Century."[147]

Our review, however, did not locate in EPA's cited NOAA sources any of the figures reported in the preamble.[148] We also carefully reviewed EPA's supporting record, including the EPA Temperature Memo that explains the methodology for estimating global temperature and sea level rise impacts, and EPA's Regulatory Impacts Analysis, the document that would typically detail key technical methodologies. But we could not identify any supporting material that explained how these numbers were calculated or what precisely they mean. Furthermore, although EPA claims that the estimated impacts on global sea level rise fall below the range of measurability,[149] we could not identify in the record either the methodology for calculating the range of global sea level rise measurability or even what EPA believes that number to be, beyond the Agency's implication that it is lower than the projected global sea level rise impact of 1.4 cm. Given the critical importance of these comparative metrics for EPA's futility findings, the agency's introduction of them in the final rule without any notice and comment, and its utter lack of transparency as to what these comparative metrics are or how they were derived, are arbitrary and capricious.

Before we further critique EPA's calculations, we first explain what the terms "variability" and "measurability" mean in relation to global temperatures. They are two distinct concepts. Climate variability is a property of the physical climate system itself. For example, global temperature variability refers to the actual physical fluctuations in average surface temperature over a specific time range. These fluctuations occur over multiple time scales—such as the daily time scales from the Earth's rotation; the yearly to multidecadal time scales of the El Niño Southern Oscillation (ENSO), the Pacific Decadal Oscillation (PDO), the Atlantic Multidecadal Oscillation (AMO), and solar cycles; up to the century or millennial time scales of anthropogenic forcings from GHG

[143] *Id.* at 7733.
[144] *Id.*
[145] *Id.* at 7721.
[146] *Id.* at 7733 & n.182.
[147] *Id.* at 7733 n.181.
[148] *See, e.g., id.* at 7733 & nn.181-82.
[149] *Id.* at 7732-33.

emissions.[150] Variability thus encompasses both short-term as well as long-term dynamics.[151] However, over longer time scales, the effects of anthropogenic climate change will dominate over the short-term fluctuations. In relation to EPA's analysis, variability captures both the desired signal (i.e., U.S. vehicle policy impacts) and surrounding noise (e.g., El Niño patterns).

By contrast, measurability is an observational and epistemic question—how precisely and accurately can we determine temperature at a given point or over a given period?[152] Measurability is affected by numerous factors, such as spatial coverage gaps (e.g., the relative lack of sensor stations in the Arctic, Southern Ocean, and parts of Africa), inhomogeneities in the records for particular stations (e.g., changes in the instruments used by that station, changes in location of the stations, time-of-observation biases in when temperatures are measured), differences between sea surface temperature datasets, and the statistical methods used to infill or interpolate.[153] Measurability defines the uncertainty envelope around estimates of what the temperature actually was. Measurability has also improved significantly over time and continues to improve with updates to instruments and methodologies.

To be clear, variability and measurability mean two completely different things. Variability refers to changes in the climate system itself. Measurability refers to how precisely and accurately we measure that system.[154] EPA suggests that both variability and measurability can be conflated into a "margin of error" such that impacts below such a threshold are meaningless. But this is conceptually

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[150] *See, e.g.*, Veronika Eyring et al., *Human Influence on the Climate System*, 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, at 436, 502, 515 (Valérie Masson-Delmotte et al. eds., 2021), https://www.ipcc.ch/report/ar6/wg1/chapter/chapter-3/.

[151] *See id.* at 517.

[152] *See, e.g.*, C.P. Morice et al., *An updated assessment of near-surface temperature change from 1850: the HadCRUT5 data set*, 126 J. of Geophysical Rsch.: Atmospheres 1, 2 (Feb. 2021), https://doi.org/10.1029/2019JD032361.

[153] *See id.* at 2-3, 15.

[154] Global sea level rise variability and measurability occur due to a different set of factors than for global temperature; however, the basic distinction between variability and measurability remains the same. Global sea level rise variability is a property of the ocean-ice-land system and refers to the actual physical fluctuations in average sea level over time—driven by factors like thermosteric expansion (ocean heat uptake), mass loss from ice sheets (Greenland, West and East Antarctica) and glaciers, changes in land water storage, and shorter-term dynamics like ENSO-driven redistribution of ocean mass and heat. By contrast, global sea level rise measurability refers to how precisely and accurately we can determine sea level at a given point or over a given period. This depends on other factors such as the uneven spatial distribution of tide gauges (concentrated along developed coastlines, sparse in the Southern Hemisphere and open ocean), corrections for vertical land motion (e.g., tectonic, sediment compaction, glacial isostatic adjustment), the calibration, reference frame stability, and inter-mission continuity of satellite altimetry records, and the statistical methods used to reconcile tide gauge and altimetry records into a coherent global mean. *See generally* Thomas Frederikse et al., *The causes of sea-level rise since 1900*. 584 Nature 393 (2020), https://doi.org/10.1038/s41586-020-2591-3; Josh Blumenfeld, *The Precision Behind Sea Level Rise,* NASA EarthData (last updated Jan. 16, 2025), https://www.earthdata.nasa.gov/news/feature-articles/precision-behind-sea-level-rise.

wrong, as variability is not a "margin of error" of global temperature; it *is* the changes in global temperature itself. By contrast, measurability can be properly understood as a margin of error in our ability to measure global temperature.

Both concepts are also completely distinct from whether reducing emissions and corresponding global temperature (or global sea level rise) changes have a material impact on human health and welfare. Commenters clearly explained the distinction between margin of error and the materiality of emission reductions.[155] In brief, suppose one were to project that in a given future year global temperature is 60 degrees, ±2 degrees, for a range of 58-62 degrees. This does not mean that a policy that reduces global temperature by 1 degree is futile, as that policy would still shift the projection to 59 degrees ±2 degrees, for a projection band of 57-61 degrees. That 1-degree reduction is plainly material given the entire band of projected outcomes shifts down by 1 degree. Moreover, as explained above, a 1degree change does not translate into the whole world becoming 1 degree cooler all the time, but rather manifests as significantly reduced incidence and intensity of local extreme weather and other unevenly distributed climate events that pose catastrophic danger to human health and welfare. EPA's conflation of measurability, variability, and the materiality of emissions reductions is irredeemably arbitrary.

1. EPA's measurability and variability values are arbitrary.

Even hypothetically accepting EPA's irrational framework, the agency's calculations for measurability and variability are technically flawed. In this section we detail such flaws and show that addressing them would yield significantly lower variability and measurability figures, such that even assuming EPA's general methodology, U.S. vehicle impacts would exceed those figures and not be *de minimis*. This below summarizes our analysis, which we further detail in Appendix C.

As with our earlier analysis, we do not intend to suggest that our figures are the appropriate metrics by which to evaluate the materiality of U.S. vehicle impacts on health and welfare; as explained above, EPA's conceptual framework for determining futility is *a priori* contrary to law and arbitrary and capricious. Comparing projected impacts of U.S. vehicle GHGs on global temperature and sea level rise with variability and measurability metrics is, at bottom, a flawed apples-to-oranges comparison. No amount of patching over the calculations can redeem what is fundamentally unsound. If anything, the fact that the ultimate finding of futility is so sensitive to the diversity of datasets, statistical techniques, and assumptions described below only further highlights the arbitrary nature of EPA's methodology.

Beginning with measurability, EPA posits that "the predicted impacts through 2100 (0.013 °C as shown in Table 5) are below the range of measurability for GMST and likewise for GSLR (1.4 cm as shown in Table 7)."[156] To begin with, this sentence has a typo, as Table 5 actually shows a projected impact of 0.037 °C for global temperature through 2100, not 0.013 °C, such that EPA understates impacts by nearly three-fold relative to what the agency's own analysis projects. EPA then claims that a NOAA data source "estimate[es] uncertainty in annual global mean surface temperature of approximately ±0.05 °C since 1950, increasing to ±0.1–0.2 °C in the late 19th

[155] *See* NGO Vehicles Comment at 104-10.
[156] 91 Fed. Reg. at 7732-33.

Century."[157] As explained above, the cited NOAA webpage does not contain these figures, nor does it report other numerical figures for measurement uncertainty.

Our review of global temperature uncertainty measurements reveals lower uncertainty values, particularly in recent decades. As explained above, measurability addresses how precisely and accurately we can determine temperature at a given point or over a given period, and it has improved alongside improvements to measurement tools and scientific methodologies. Commenters demonstrated that projected temperature changes from U.S. vehicle GHGs are in fact measurable. For example, "Berkeley Earth reports a highly precise measurement of global temperature, with 95% confidence uncertainties of 0.03 °C for a single year."[158] This uncertainty level is below EPA's projected 2100 global temperature impact of 0.037 °C, indicating that even assuming EPA's preferred methodology, EPA's conclusion that U.S. vehicle emissions are *de minimis* is arbitrary and capricious.

In addition, the NOAA website referenced by the Final Rule cites to NOAAGlobalTemp data. Based on that dataset, Huang et al. (2020) reports that the uncertainty in globally averaged annual surface temperatures has gradually decreased over the twentieth century, reaching "approximately 0.02 °C in the 2010s except for spikes during the two world wars."[159] Again, this value is below EPA's projected global temperature impact of 0.037 °C, so that even assuming EPA's methodology, U.S. vehicle emissions are not *de minimis*.

We were able to identify one paper, Lenssen et al. (2019), that reported the ±0.05 °C measurement uncertainty for recent decades and between 0.1 to 0.2°C figures for the 19th century that EPA referenced.[160] However, a newer paper by Lenssen et al. (2024) updates the measurement uncertainty values to only 0.035°C.[161] Appendix C collects these and additional sources of measurement uncertainty figures. When looking at the time period since 1950, all sources of measurement uncertainty that we identified report values lower than the 0.05 °C identified by EPA. The same is true when looking at the time period since 1970, with values falling as low as

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[157] *Id.* at 7733 n.181.

[158] Comment submitted by Nathan Sweet et al. 4, Docket No. EPA-HQ-OAR-2025-0194-1461; *see also* Robert Rohde, Global Temperature Report for 2025, Berkeley Earth (Jan. 14, 2026), https://berkeleyearth.org/global-temperature-report-for-2025/; Robert Rohde & Zeke Hausfather, *The Berkeley Earth Land/Ocean Temperature Record*, 12 Earth Syst. Sci. Data 3469, at Fig. 2 (2020), https://essd.copernicus.org/articles/12/3469/2020/ ("Berkeley Earth Jan 2025 Update").

[159] Boyin Huang et al., *Uncertainty Estimates for Sea Surface Temperature and Land Surface Air Temperature in NOAAGlobalTemp Version 5*, 33 Journal of Climate 1351, 1368 (2020), https://doi.org/10.1175/JCLI-D-19-0395.1. This Huang paper is based on version 5 of the NOAAGlobalTemp dataset. As we explain in Appendix C, the latest version 6 of this dataset does not report measurement uncertainty values.

[160] Nathan J.L. Lenssen et al., *Improvements in the GISTEMP uncertainty model.* 124 J. of Geophysical Rsch.: Atmospheres 6307, 6307 (2019), https://doi.org/10.1029/2018JD029522.

[161] Figure calculated by petitioners based on data provided by author. Discussion of calculation can be found in Appendix C, citing Nathan J.L. Lenssen et al., *A NASA GISTEMPv4 observational uncertainty ensemble*, 129 J. of Geophysical Rsch.: Atmospheres 1 (2024), https://doi.org/10.1029/2023JD040179.

0.011 °C.[162]

EPA, moreover, fails to explain why it is appropriate to look at *annual* uncertainty metrics when the policies in question are long-term pollution control policies with impacts that occur over multiple decades. For example, EPA itself notes that "fleet turnover (*i.e.,* the transition from existing vehicles to new vehicles covered by the standards) generally takes more than 20 years,"[163] and for this reason, the agency continues to project regulatory impacts over a multi-decadal period.[164] And as commenters explained, global temperature measurement uncertainty can decrease when averaging time periods of greater length.[165] For example, Berkeley Earth reports five-year uncertainty values lower than annual uncertainty values (e.g., for 2022, the five-year uncertainty is 0.027 °C, while the annual uncertainty is 0.031 °C), and a thirty-year uncertainty value that is far lower than annual values (e.g., for 1951-80, the uncertainty is 0.019 °C, compared to annual uncertainties that range from 0.026-0.079 °C during that time period).[166]

Turning to global sea level rise measurement uncertainty, EPA does not report any value or methodology, beyond implying the value exceeds 1.4 cm. Our review of global sea level rise measurement uncertainty found that NASA reports annual global sea level rise uncertainties of only 4.0 mm, or 0.4 cm, per year.[167] The 1.4 cm global sea level rise change projected by EPA in 2100 is 3.5 times (i.e., 250% greater than) this measurement uncertainty value. This demonstrates that even applying EPA's preferred methodology, EPA's conclusion that U.S. vehicle emissions are *de minimis* is arbitrary and capricious.[168]

EPA's technical analysis of global temperature variability is also wrong. As explained above, the referenced NOAA website does not provide the 0.14 °C figure cited by EPA, nor does the Agency elaborate on its methodology. Our review was able to reconstruct the 0.14 °C value by taking the sample standard deviation of annual temperature data from 2016-25. For purposes of this

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[162] *See* Appendix C, Fig. 14, citing Chan et al., Dynamically Consistent Ensemble of Temperature (DCENT) (Jan. 14, 2026), https://dcent-i.github.io; DCENT_DCENT_I_GMST_annual_statistics, https://www.dropbox.com/scl/fi/c8ohkby3kbq98jyx7c7i1/DCENT_DCENT_I_GMST_annual_statistics.txt?rlkey=wt7436fexkijiqfltnvt43681&e=2&st=px7uqc2n&dl=0.

[163] 91 Fed. Reg. at 7732.

[164] EPA's RIA projects regulatory impacts through 2055.

[165] Comment submitted by Nathan Sweet et al. 4, Docket No. EPA-HQ-OAR-2025-0194-1461.

[166] *See* Berkeley Earth Jan 2025 Update.

[167] NASA, *Global Mean Sea Level*, https://sealevel.nasa.gov/understanding-sea-level/key-indicators/global-mean-sea-level/ (last visited Apr. 15, 2026). *See also* Michael Ablain et al., *Uncertainty in satellite estimates of global mean sea-level changes, trend and acceleration*. 11 Earth Sys. Science Data 1189 (2019), https://essd.copernicus.org/articles/11/1189/2019/.

[168] To the extent that EPA later identifies sources reporting higher measurement uncertainty in response to this petition, any such sources do not exist in the final rule itself and are not part of the record, and thus the agency is still required to convene a proceeding for reconsideration. In any event, any such sources cannot cure EPA's error in comparing projected emissions impacts with uncertainty values, which is a fundamentally apples-to-oranges comparison.

part of our petition, we assume this is the methodology EPA used.[169]

This methodology is fundamentally flawed for several reasons. First, standard deviation measures the amount of variation of a variable around its arithmetic average. For example, suppose the average life expectancy of adult men in the U.S. is 78 years. The standard deviation would then measure how dispersed adult male life expectancy is from the average, e.g., are the majority of men within one year on either side of the average or within ten years? However, global temperature data from 2016-25 are not intended to measure values around a stable arithmetic average. Rather, they measure the trend in temperature over time, a trend that is noticeably increasing due to anthropogenic greenhouse gas emissions. In other words, it makes no sense to pretend that the temperature values from 2016-25 are scattered around one stable average temperature, when the annual temperatures are obviously going up over time and with increasing atmospheric GHG levels, as shown in the figures below.

[169] To the extent EPA later chooses to defend its result based on another methodology for calculating the 0.14 °C figure, that methodology does not exist in the final rule, and the agency must nonetheless convene a proceeding for reconsideration.

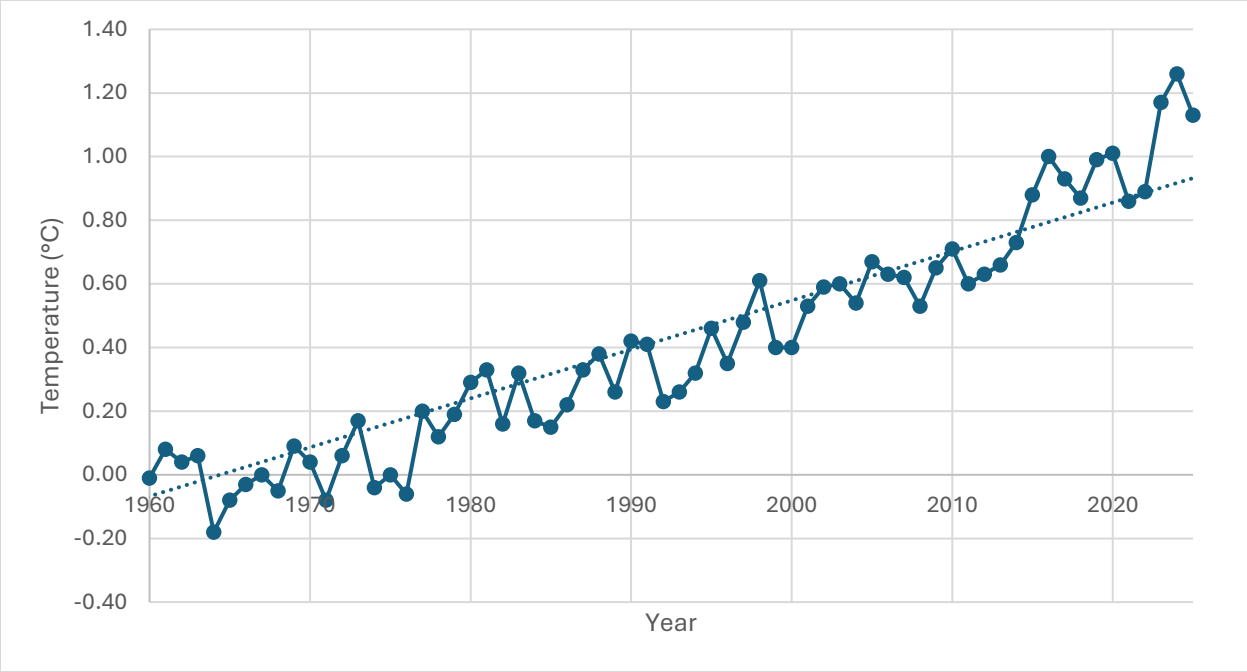

Figure 1 Global Temperature Anomalies Over Time, 1960-2025, Relative to 1901-2000 Average Global Temperature.

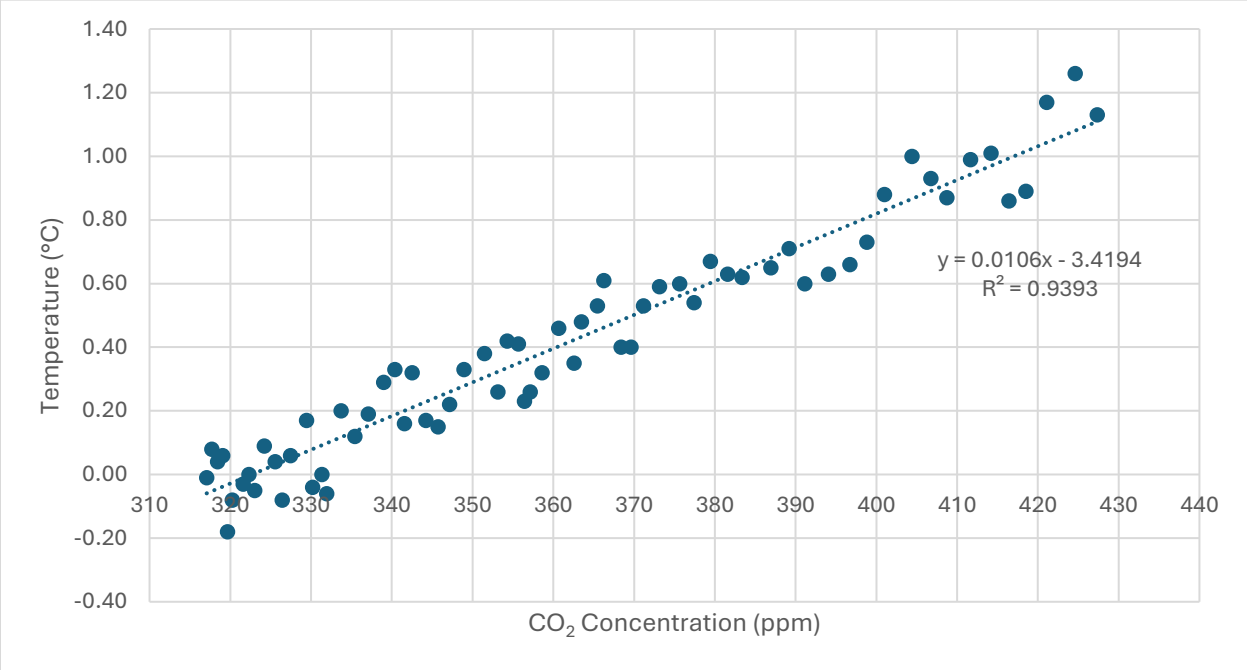

Figure 2 Global Temperature Anomalies Relative to Atmospheric CO_2 concentration (ppm), 1960-2025 Relative to 1901-2000 Average Global Temperature.

Calculating a sample standard deviation without accounting for these trends would mean that a perfectly linear increase in temperatures could have the same standard deviation as highly noisy data that bounce around each other. For example, the two lines in the figure below have the

exact same values, but they are arranged in different orders. That ordering makes a visible difference, such that the blue line displays a clear increasing trend, while the green line displays noisy datapoints that are bouncing around. But EPA's approach would mean that these two lines have the exact same variability. That makes no sense. In this case, a better metric of variability would account for the trend in the blue line and indicate that it has lower variability than the green line.

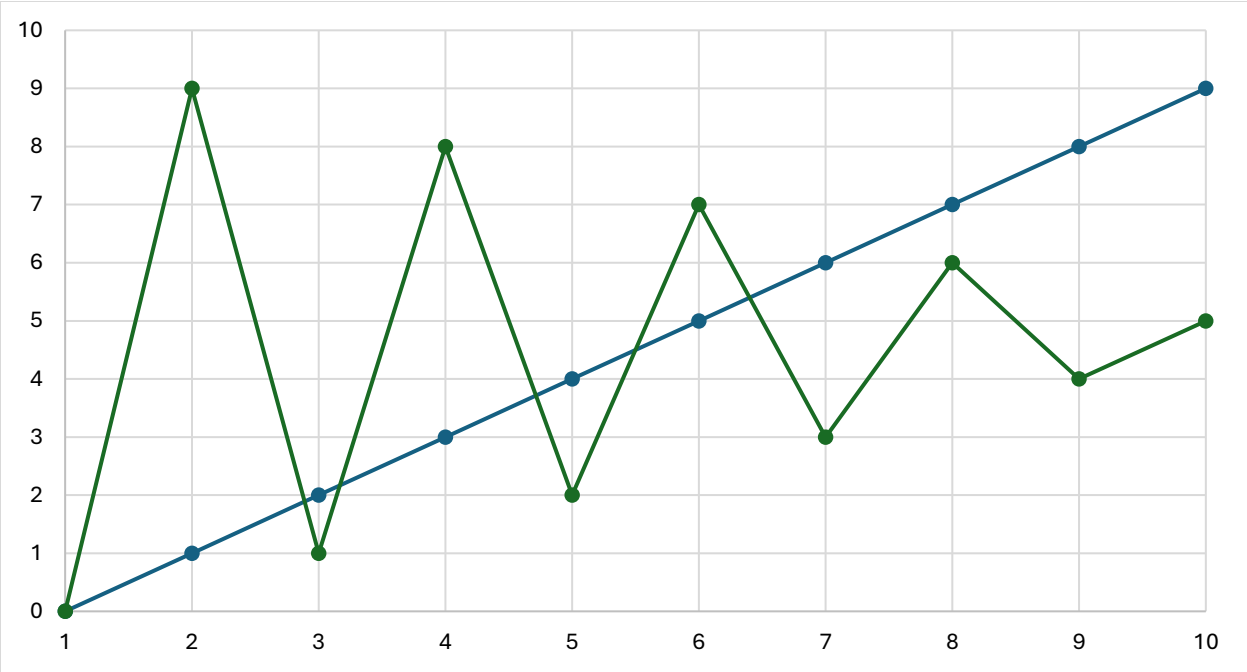

Figure 3 Two Sample Datasets (Green and Blue Dots and Lines) Showing the Importance of Accounting for Trends in Determining Variability

Second, the timeframe of the data inputs is consequential. There are two key components of this timeframe. The first component is the period across which temperatures are averaged for each datapoint, for example, whether each datapoint represents averages across one month, one year, or ten years. EPA's cited source appears to average the data across one year. The second timeframe component is the period for the analysis as a whole, including the number of years and when the analysis begins and ends. For example, EPA assesses a ten-year period beginning in 2016 and ending in 2025.

EPA does not explain why annually averaged data from the ten-year period of 2016-25 are the right inputs. The Agency's referenced NOAA website itself highlights that changing the temporal parameters can result in significantly different datasets.[170] In Appendix C, we further

[170] 91 Fed. Reg. at 7733 n.182 (citing NOAA, National Centers for Environmental Information, *Climate at a Glance: Global Time Series*, https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/globe/land_ocean/tavg/ytd/12/1950-2025 (last visited Apr. 15, 2026)). The cited NOAA webpage contains multiple temporal parameters that the user can adjust and that significantly affect the results, including parameters for "Time Scale," "Month," "Start Year," and "End Year."

elaborate on the sensitivity of the variability figure to these temporal parameters, showing that selection of the ten-year period from 2016-25 happens to result in unusually high variability relative to other time periods. Given that EPA is asserting that GHG regulation is facially futile, the agency is obligated to demonstrate that such futility exists not only in a single arbitrarily cherrypicked timeline but across a wide range of reasonable periods. Moreover, as commenters explained, climate change induced by increasing GHG pollution is not a short-term annual phenomenon, but rather occurs over long periods of time, as GHG pollution accumulates and causes increasing temperatures, climate volatility, and other impacts that endanger human health and welfare.[171]

To understand the variability in the long-term state of the climate, apart from short-term variations (such as the El Nino and other ocean-atmospheric oscillations described above), scientists often look at temperature data averaged over longer time periods than just one year.[172] To put it simply, while annual temperatures tell us what the atmosphere is doing right now, including in response to temporary natural cycles, longer-term assessments allow scientists to discern whether the climate is changing in more permanent ways, such as in response to climate pollution.

Moreover, annual temperatures during 2016-2025 exhibited especially high variability relative to most prior ten-year periods. EPA's selection of this time window biases variability upwards due to historically anomalous climate behavior resulting from climate change. That is, the 2016-2025 period coincides with some of the highest recorded GHG concentrations in human history. At these elevated GHG concentrations, the climate system is operating in a regime that is measurably different from earlier decades, with altered patterns of climate extremes that are themselves a consequence of the underlying warming trend. That is to say, the elevated variability during the 2016-2025 window is not random and does not merely reflect natural internal climate variability. It is at least partly a reflection of the altered climate state produced by the very GHG emissions whose regulation EPA now claims are meaningless. The Agency's argument is therefore circular: the elevated variability EPA cites as a reason not to regulate is itself a consequence of the kind of emissions that Clean Air Act section 202(a) GHG regulation is meant to address.

Third, EPA arbitrarily used the sample standard deviation in lieu of population standard deviation. The Agency purports to have calculated "variability in GMST measurement from 2016 to 2025."[173] Taking EPA at its word that it meant to calculate global temperature variability from 2016-25, the Agency should have used population standard deviation, as we know the temperature data for each year from 2016-25, i.e., the entire "population" of years. This is not a situation where we only know the temperature from a subset, or "sample" of those years, so it is statistically unsound to apply the sample standard deviation. Alternatively, to the extent EPA actually meant to calculate global temperature variability across a longer time period and relied upon 2016-25 data as a sample, the Agency erred in not choosing a random sample and in arbitrarily selecting the 2016-25 time period, which yields atypically high variability, as we further explain in Appendix C.

We calculate lower variability metrics when we address each of the above flaws, and

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[171] *See* section IV.B.4 above.

[172] NOAA, National Centers for Environmental Information, *Accounting for Natural Variability in Our Changing Climate* (Aug. 5, 2019), https://www.ncei.noaa.gov/news/accounting-natural-variability-our-changing-climate.

[173] 91 Fed. Reg. at 7691; *see also id.* at 7733 ("GMST variability from 2016–2025").

considerably lower variability when we address multiple flaws at once. For example, when we account for the relationship between temperature and atmospheric CO_2 concentrations, use 10-year averages (as opposed to annual averages) of temperature data from 1965 to 2025, and calculate population standard deviation, we determine a variability of only 0.0193 °C. This value is roughly 14% of EPA's reported variability 0.14 °C, that is, roughly 86% smaller than EPA's value. Notably, EPA's projection of U.S. vehicle GHG impacts in 2100 of 0.037 °C also significantly exceeds this value, such that even otherwise assuming EPA's general methodology of assessing temperature variability, the impacts of U.S. vehicle GHGs are not *de minimis*.[174]

2. Addressing the compounding flaws in EPA's modeling and variability and measurability metrics further illustrates the meaningful impact of U.S. vehicle GHG emissions.

EPA purports to compare modeled global temperature and sea level impacts with variability and measurability metrics. As explained above, EPA's modeling proceeds from arbitrary choices which depress the modeled impacts, while its variability and measurability metrics are arbitrarily elevated. These flaws compound each other, and when we address both sets of flaws at the same time, we observe that the impacts of U.S. vehicle GHGs on global temperature and sea level actually far exceed EPA's variability and measurability comparators, in some cases by more than an order of magnitude. As there are numerous permutations of such comparisons, we present only a sampling of potential comparisons to illustrate the severity of EPA's errors.

Beginning with temperature, as explained above, we report a temperature variability statistic of as low as 0.0193 °C, based on our calculations after addressing the various flaws implied in EPA's reported figure. We also report a measurement uncertainty of 0.02 °C based on the specific dataset contained in EPA's source, as well as other measurability statistics lower than the 0.05 °C cited by EPA, with the lowest at 0.011 °C. As already explained, EPA's reported 2100 temperature impact of 0.037 °C exceeds these metrics, so that even otherwise assuming EPA's methodology, such impacts are not *de minimis*. When we address the flaws in EPA's modeling, we report significantly higher temperature impacts, for example 0.115 °C in 2200 assuming EPA's emissions inputs (Scenario A) and 0.269 °C in 2200 had EPA never regulated vehicle GHGs (Scenario C). These figures far exceed the measurability and variability comparators. For example, in a scenario where EPA had never regulated vehicle GHGs, the temperature impacts by 2200 (0.269 °C, Scenario C) could be 24 times the size of the above-reported measurement uncertainty metric (0.011 °C) and be nearly 14 times the size of the above variability metric (0.0193°C).

The same story holds true for sea level rise changes. We report a measurement uncertainty of 0.4 cm based on a NASA dataset.[175] As already explained, EPA's reported 2100 sea level rise impact of 1.4 cm is already 3.5 times this amount. When we address the flaws in EPA's modeling, we report significantly higher sea level rise impacts, for example 6.39 cm in 2200 assuming EPA's emissions inputs (Scenario A) and 14.37 cm in 2200 had EPA never regulated vehicle GHGs (Scenario C). These figures grossly exceed the measurability uncertainty. For example, in a scenario where EPA had never regulated vehicle GHGs, the sea level rise impacts by 2200 (14.37 cm, Scenario C) could

[174] We detail our calculations for this scenario, as well as other scenarios, in Appendix C.
[175] As noted above, EPA does not calculate a variability statistic for sea level, so we also do not present a variability statistic here.

be nearly 36 times the size of the above measurement uncertainty metric (0.4 cm).

3. EPA's new measurability and variability tests cannot be reconciled with prior agency determinations that even smaller impacts are meaningful for Clean Air Act section 202(a) regulatory purposes.

EPA also neglects to explain why it is adopting these new comparative metrics for global temperature and sea level rise impacts at all, when earlier GHG rules explicitly found that small changes in global temperature and sea level rise—including changes over an order of magnitude smaller than the agency is now modeling—are in fact meaningful. This argument was made in public comments,[176] and given EPA's newfound focus on global temperature and sea level rise, we further elaborate the argument here.

For example, in the 2010 light-duty GHG rule, EPA's modeling of the rule's impacts showed that "global mean temperature is estimated to be reduced by 0.006 to 0.015 °C by 2100 . . . and sea-level rise is projected to be reduced by approximately 0.06-0.14cm by 2100."[177] EPA then addressed adverse comments "that the projected changes in climate impacts resulting from this action are small and therefore not meaningful," stating that the agency "disagrees with this view as the reductions may be small in overall magnitude, but in the global climate change context, they are quantifiable showing a clear directional signal across a range of climate sensitivities. EPA therefore determines that the projected reductions in atmospheric CO_2, global mean temperature and sea level rise are meaningful in the context of this rule."[178] EPA further explained that such changes were meaningful regardless of whether they were within the range of measurement sensitivity, and that measurability was not an appropriate criterion for evaluating the materiality of GHG emissions reductions.[179] Finally, EPA noted that its "rule takes many factors into consideration," and that apart from global temperature and sea level rise impacts, "[t]he benefits of GHG emissions reductions can be characterized both qualitatively and quantitatively, some of which can be monetized."[180] Later EPA vehicle GHG rules reprised similar modeling exercises and continued to find that even smaller impacts on global temperature and sea level rise lead to meaningful health and environmental effects.[181]

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[176] NGO Vehicles Comment at 110.
[177] 75 Fed. Reg. at 25495.
[178] *Id.*
[179] *See* EPA Response to Comments Document for Joint Rulemaking of Light-Duty Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards (2010), 5-389 to 5-390.
[180] *Id.* at 5-391.
[181] *See, e.g.*, 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62624, 62895-96 (Oct. 14, 2012) ("Although the projected reductions and improvements are small in comparison to the total projected climate change, they are quantifiable, directionally consistent, and will contribute to reducing the risks associated with climate change. Climate change is a global phenomenon and EPA recognizes that this one national action alone will not prevent it: EPA notes this would be true for any given GHG mitigation action when taken alone or when considered in isolation. *See Coalition for Responsible Regulation* v. *EPA* . . . noting that the GHG emission reductions of the MYs 2012-2016 rule 'result in meaningful mitigation of greenhouse gas emissions'; the projected emissions reductions of this MYs 2017-2025 rule are projected to be approximately double those of the MYs

The Final Rule's modeled changes in global temperature and sea level rise from U.S. vehicle emissions are far greater than those projected in earlier rules. For example, compared to the 2010 LD GHG rule, the Final Rule's modeled global temperature changes are roughly 2.5 to 6 times larger, and global sea level rise changes are 10 to 23 times larger. Despite this, EPA has not reconciled its prior finding that its GHG standards had meaningful impacts with its novel conclusion that the far greater impacts of all U.S. vehicle GHGs—and all standards in any conceivable circumstance—are now *de minimis,* nor has it even acknowledged this sudden about-face[182] EPA's failure to address the reasoning provided in the earlier rules renders its deviation from past practice procedurally unexplained and substantively wrong.[183]

B. EPA articulates a novel 1% test for *de minimis* impacts found nowhere in the proposal, and that test is both contrary to law and arbitrary and capricious.

In the Final Rule, EPA announces for the first time a 1% test for determining whether emission impacts are *de minimis* and therefore allegedly absolve EPA of its statutory duty to make an endangerment finding under Clean Air Act section 202(a)(1). EPA asserts that the impact of its 50%-reduced emissions scenario on trends in global temperature and sea level rise equals less than 1% of the projected changes through 2050 and 2100.[184] Based on this novel 1% test, EPA concludes, "these impacts are *de minimis* and . . . the futility of GHG emission standards under CAA section 202(a)(1) further supports the understanding that Congress did not design that provision to authorize or require the Administrator to prescribe standards in response to global climate change concerns."[185]

Petitioners had no opportunity to comment on the use of 1% as an appropriate or dispositive *de minimis* threshold for evaluating whether emission standards under Clean Air Act section 202 are futile. EPA's proposed rescission of the Endangerment Finding failed to mention even once, let alone propose, the use of such threshold. EPA's proposal faulted the Endangerment Finding for allegedly failing to "consider the extent to which emissions from CAA section 202(a) sources have a more than *de minimis* effect on the danger identified with respect to elevated

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2012-2016 rule so that this rule obviously results in 'meaningful mitigation of greenhouse gas emissions' as well."); Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 76 Fed. Reg. 57106, 57298-99 (Sept. 15, 2011)(similar); Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 81 Fed. Reg. 73478, 73835 (Oct. 25, 2016)(similar).

[182] *See FCC v. Fox TV Stations, Inc., 556 U.S. 502, 515 (2009)* ("The requirement that an agency provide reasoned explanation for its action would ordinarily demand that it display awareness that it *is* changing position. An agency may not, for example, depart from a prior policy *sub silentio* or simply disregard rules that are still on the books.").

[183] EPA's RTC specifically recognizes the lower impacts found in the 2010 Light-Duty GHG rule, but the agency fails to justify —and could not reasonably justify—why it now considers impacts that were previously found meaningful to no longer be meaningful. *See* RTC at 219.

[184] 91 Fed. Reg. at 7691.

[185] *Id.*

concentrations of GHGs in the upper atmosphere," as well as, "whether emissions from any particular class or classes of sources that EPA intended to regulate had such [a *de minimis*] effect."[186] While EPA's proposal invoked *de minimis* principles as a proposed basis to repeal the Endangerment Finding, nowhere does it state, or even suggest, that 1% constitutes a *de minimis* threshold that would determine whether regulation is futile. Instead, the proposal used the 2025 Climate Working Group Draft Report's analysis (which the Final Rule *expressly disclaims* reliance upon for any purpose) to suggest an approximately 3% reduction in predicted warming trends is a *de minimis* impact.[187] By contrast, the Final Rule purports to rely on judicial precedent to derive a completely different threshold for *de minimis* impacts. Therefore, it was clearly impracticable during the comment period on the proposal for Petitioners or any member of the public to raise any objections to the Final Rule's 1% de minimis threshold. For the reasons described below, EPA must convene a proceeding to reconsider its new de minimis threshold. EPA's selection of a 1% threshold to determine futility has no basis in judicial precedent and is arbitrary and capricious.

EPA's failure to provide an adequate notice of the 1% *de minimis* threshold deprives Petitioners and other members of the public of the opportunity to comment on EPA's arbitrary and capricious justification for this threshold. EPA misleadingly claims that "regulatory agencies and courts have consistently viewed impacts of 1% as *de minimis* and therefore not encompassed within general statutory language."[188] Contrary to EPA's claims, general principles of *de minimis* case law make clear that determining when something is "truly *de minimis* naturally will turn on the assessment of particular circumstances, and the agency will bear the burden of making the required showing."[189] Whether an amount is *de minimis* depends on whether the regulation will "yield a gain of trivial or no value,"[190] and "the Agency must follow a rational approach to determine what level of emission is a *de minimis* amount."[191] Yet EPA made no effort to "bear [its] burden" of showing that the Final Rule's 1% threshold weeds out "truly *de minimis*" emissions in the context of regulating mobile source GHGs.[192] The Final Rule's 1% threshold is also contrary to the principle that the *de minimis* doctrine "is not available to thwart a statutory command,"[193] "but rather [it is] a tool to be used in implementing the legislative design."[194] Commenters' critiques of the same flawed statutory interpretation of Clean Air Act section 202(a) advanced by EPA in the proposal apply with equal weight here.[195]

EPA cites to five cases in support of its novel proposition that regulatory agencies and courts have consistently viewed impacts of 1% as *de minimis*, misconstruing and misapplying each one in a futile attempt to justify its arbitrary threshold.[196] All five cases use different thresholds, and none identify a particular threshold that broadly applies as *de minimis* in all circumstances. Of the

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[186] 90 Fed. Reg. at 36304.
[187] 90 Fed. Reg. at 36311.
[188] 91 Fed. Reg. at 7733.
[189] *Alabama Power Co. v. Costle*, 636 F.2d 323, 360 (D.C. Cir. 1979).
[190] *Id.* at 361.
[191] *Id.* at 405.
[192] *Id.* at 360.
[193] *Pub. Citizen v. Young*, 831 F.2d 1108, 1113 (D.C. Cir. 1987).
[194] *Alabama Power Co.*, 636 F.2d at 360.
[195] *See* NGO EF Comment at 85-89.
[196] 91 Fed. Reg. at 7686 n.185.

cited cases, *EPA v. EME Homer City Generation, L.P.*, 572 U.S. 489 (2014), is the only case in which an agency utilized a 1% *de minimis* threshold. Yet this case and underlying rule involved a different statutory provision and different record, and it provides no support for EPA's assertion that the courts have "consistently viewed" such a threshold as *de minimis*. Clean Air Act section 110(a)(2)(D)(i), the provision at issue in *EME Homer*, conditions state implementation plan obligations on whether upwind air pollution "contribute[s] significantly to nonattainment" in downwind states. The interstate air pollution Transport Rule at issue in *EME Homer* used 1% of the relevant National Ambient Air Quality Standards (NAAQS) to screen out upwind contributions below that threshold for purposes of further regulation, but it did not use that threshold alone to determine which amounts of air pollution do or do not constitute "amounts which will . . . contribute significantly."[197] The Final Rule's suggestion that the 1% threshold used in that context supports the use of a 1% threshold in deciding whether regulation under Clean Air Act section 202(a) is futile misrepresents *EME Homer*; the Court never so much as hints that the 1% threshold at issue there is appropriate in any other context.

Additionally, EPA's arbitrary and capricious reliance on the 1% threshold in the Transport Rule as justification for a *de minimis* threshold in the Final Rule ignores both the purpose of that threshold in the context of Clean Air Act section 110(a)(2)(D)(i) and EPA's robust analytical work to justify that threshold within that different context. The Transport Rule used the 1% threshold to regulate a large (albeit not complete) set of contributors that create most of the downwind nonattainment problem. By contrast, EPA in the Final Rule uses the 1% threshold to disclaim *any responsibility at all* to implement the statutory command under Clean Air Act section 202(a)(1) to regulate mobile source GHGs that endanger public health and welfare. Additionally, EPA provides no technical justification whatsoever for the use of such threshold in the Final Rule, whereas the Transport Rule, in seeking to identify a rational solution to the downwind pollution problem exacerbated by collective upwind pollution, contained significant technical analyses of several potential thresholds in order to justify the use of 1%.[198] The Transport Rule's use of 1% was thus a carefully selected screening threshold in order to efficiently resolve most of the downwind pollution problem; it was not a *de minimis* threshold used to justify defying the Clean Air Act's legislative design, nor was it ever intended to apply across other Clean Air Act programs that tackle entirely different problems.

EPA's use of the 1% *de minimis* threshold to determine the futility of regulating GHGs from new motor vehicles and engines under Clean Air Act section 202 is of central relevance to the Final Rule. EPA states that its futility rationale is a sufficient independent basis to support its rescission of the Endangerment Finding. EPA argues that "CAA section 202(a)(1) requires that emission standards be capable of having a material impact on the identified danger for the Administrator to conclude that the emissions 'contribute' to air pollution that may 'reasonably be anticipated' to endanger public health and welfare."[199] EPA's finding that vehicle GHG emissions standards are futile is based on its analysis of whether new vehicle and engine standards for GHGs have less than 1% impact on modeled global temperature and sea level rise. The 1% threshold is thus centrally relevant to the Final Rule, as it is a dispositive basis for EPA's futility finding and its consequent

[197] *EME Homer*, 572 U.S. at 495.
[198] Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48208, 48237 (Aug. 8, 2011).
[199] 91 Fed. Reg. at 7733.

repeal of the Endangerment Finding and associated GHG standards.

Because it was impracticable to raise objections to the 1% threshold at the time of proposal, and the 1% threshold is of central relevance to EPA's rescission of the Endangerment Finding and related emission standards, EPA is required to grant reconsideration on this issue.

VI. EPA TAKES A NEW POSITION THAT IT CANNOT MONETIZE CRITERIA POLLUTANT HEALTH BENEFITS ASSOCIATED WITH THE VEHICLE GHG STANDARDS.

Commenters provided extensive comments on EPA's flawed analysis of the proposal's emissions and health impacts from criteria pollutants.[200] However, EPA claims for the first time in the Final Rule that due to analytical uncertainties, it cannot monetize health benefits resulting from ozone and particulate matter pollution reductions achieved by the vehicle GHG standards.[201] Essentially zeroing out certain health benefits associated with the standards—benefits that EPA accounted for when initially adopting the standards, on the basis of purported uncertainties—is unreasonable and contrary to EPA's own prior determinations. By generically stating that costs are immense while casting aside any quantification, or even qualification, of health benefits, EPA has produced an egregiously skewed analysis to support repealing the GHG emission standards that precludes fair comparison of regulatory alternatives.[202]

EPA's abrupt reversal on benefits quantification also flouts established administrative law principles. When an agency reverses a longstanding policy, it must acknowledge it is changing course and, in some cases, provide a more "detailed" and "reasoned" justification than in a circumstance where it is operating on a blank slate.[203] Here, EPA's stated justification for declining to report and consider hundreds of millions of dollars, if not billions of dollars, in potential quantified health benefits—set forth in a brief explanation in the Final Rule with no notice of EPA's novel position in the proposal—falls far short of that standard.

As an initial point, EPA fails in the Final Rule to acknowledge the extent to which it is changing course and the nature of the scientific foundation and support for its prior approach. In the brief passage that EPA devotes to the announced policy change, it does not once even reference its peer-reviewed, twelve-chapter, four-hundred-plus page Guidelines for Economic Analyses, or begin to explain why its numerous specific departures from the specific recommendations therein

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[200] *See, e.g.*, State Attorney Generals and Chief Legal Officers, Comments on the Proposed Reconsideration of 2009 Endangerment Finding and Greenhouse Gas Vehicle Standards, Docket No. EPA-HQ-OAR-2025-0194-2947, at 81-89.
[201] 91 Fed. Reg. at 7757.
[202] *Cf. Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1198 (9th Cir. 2008) (where an agency uses a cost-benefit analysis, it "cannot put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards").
[203] *FCC v. Fox Television Stations, Inc.*, 556 U.S. 502, 515-16 (2009).

are justified (even though to this day EPA commits to adhering to those guidelines on its website).[204] EPA provides no explanation as to why its long-standing methods for evaluating and presenting uncertainties around its health impacts estimates are no longer appropriate. Nor does EPA acknowledge that nearly all aspects of its prior approach have been extensively vetted and endorsed by its Science Advisory Board. Nor does EPA explain why it is violating the requirement in Executive Order 12,866, which compels the Agency to quantify health benefits to the fullest extent possible.

Under these circumstances, EPA's brief acknowledgement that it held a previous practice of quantifying environmental benefits is not enough to meet requirements for adequately explaining a shift in Agency position. EPA's obligation to "provide a reasoned explanation" for "disregarding" the specific "facts and circumstances that underlay or were engendered by the prior policy," encompasses an obligation to acknowledge and address all of the particular factual premises and reasoning that underpinned the Agency's longstanding prior approach to benefits quantification.[205] Thus, EPA must not just acknowledge the general change in policy direction, it must disclose each of the pertinent aspects of its Guidelines that it is now departing from, and provide a reasoned explanation for abandoning all of them. EPA falls short of doing so in announcing its sudden refusal to quantify health benefits. Indeed, EPA in the Final Rule does not even acknowledge that it has in place extraordinarily detailed and rigorously peer-reviewed economic analysis guidelines.

An opportunity to raise objections to EPA's devaluing of criteria pollutant health benefits based on supposed analytical uncertainties would allow Petitioners and the public to demonstrate the arbitrary and capricious nature of this aspect of the Final Rule. EPA identifies no new scientific evidence or flaw in the existing scientific literature that could justify entirely failing to quantify or monetize health benefits wholesale. EPA principally points to uncertainty, stating that its "analytical practices often provided the public with false precision and confidence regarding the monetized impacts of fine particulate matter ($PM_{2.5}$) and ozone than the underlying science could fully support."[206] But that explanation does not disclaim that health benefits actually exist, nor does it acknowledge that its wholesale failure to quantify those benefits instills the much *greater* false sense that the benefits are in fact negligible, as EPA now effectively treats them. Nor does EPA's conclusory statement acknowledge or grapple with the strong scientific underpinnings for the Agency's longstanding approach to assess health impacts associated with ozone and particulate matter in its previous rulemakings—including the suite of Integrated Scientific Assessments and Technical Support Documents documenting EPA's analytical methods and characterizing sources of uncertainty; the Scientific Advisory Board and Clean Air Scientific Advisory Committee reviews that scrutinized and supported EPA's methods for assessing health impacts; and the Agency's guidelines for economic analysis that have guided the development of its methodologies.[207] The Final Rule

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[204] *See* EPA, Guidelines For Preparing Economic Analyses, 3rd Edition, https://www.epa.gov/environmental-economics/guidelines-preparing-economic-analyses-3rd-edition (last visited April 15, 2026) ("The EPA will use the *Guidelines* to evaluate the economic consequences of its regulations and policies").

[205] *Id.*

[206] 91 Fed. Reg. at 7757.

[207] *See, e.g.,* EPA, *Guidelines for Preparing Economic Analyses, 3rd Edition* at 1-1 (Dec. 2024), https://www.epa.gov/system/files/documents/2024-12/guidelines-for-preparing-economic-analyses_final_508-compliant_compressed.pdf; EPA, *Estimating PM2.5- and Ozone-Attributable Health*

never explains why this well-vetted and transparent approach now fails to pass muster—or why it is reasonable for EPA to provide *no estimates whatsoever* of the health impacts of its Final Rule, as opposed to utilizing its existing approaches while working to improve them over time.[208]

The novel and sudden decision to not quantify health benefits at all on the basis of supposed analytical uncertainties is of central relevance to the Final Rule, because it is fundamental to EPA's new conclusion that retaining the standards is unreasonable.[209] Accordingly, mandatory reconsideration is required on EPA's decision to not monetize health benefits resulting from ozone and particulate matter pollution reductions associated with retaining the vehicle GHG standards.

VII. CONCLUSION

For the foregoing reasons, Petitioners respectfully request that the Administrator convene a proceeding for reconsideration of the specified aspects of the Final Rule pursuant to Clean Air Act section 307(d)(7)(B).

Benefits: 2024 Update 103 (June 2024), https://www.epa.gov/system/files/documents/2024-06/estimating-pm2.5-and-ozone-attributable-health-benefits-tsd-2024.pdf; EPA, *Technical Support Document: Estimating the Benefit per Ton of Reducing Directly-Emitted PM2.5, PM2.5 Precursors and Ozone Precursors from 21 Sector*s at Att. 105, p. 6 (June 2024) (Docket No. EPA-HQ-OAR-2024-0419-0013); Supplement to the 2019 Integrated Science Assessment for Particulate Matter, 87 Fed. Reg. 22207 (Apr. 14, 2022); Letter from Elizabeth A. (Lianne) Sheppard, Chair, Clean Air Scientific Advisory Committee, to Administrator Michael S. Regan, *Re: CASAC Review of the EPA's Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter* (Mar. 18, 2022), https://www.4cleanair.org/wp-content/uploads/PM-NAAQS-CASAC-Responses-to-EPA-PM-Draft-PA-031822.pdf; EPA, *Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter* (2021), https://www.epa.gov/system/files/documents/2021-10/final-policy-assessment-for-the-review-of-the-pm-naaqs-01-2020.pdf.

[208] *See Ctr. for Biological Diversity v. NHTSA*, 508 F.3d 508, 534 (9th Cir. 2007) (finding that federal agency's refusal to quantify benefits of greenhouse gas reduction was arbitrary because "while the record shows that there is a range of values, the value of carbon emissions reduction is certainly not zero," and because the agency "has monetized other uncertain benefits" such as "crash, noise, and congestion costs").

[209] 91 Fed. Reg. at 7734.

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VIII. TRANSMISSION AND ATTACHMENTS

A copy of the foregoing Petition for Reconsideration and accompanying appendices is being sent on April 15, 2026, by email, and on April 16, 2026, by mail, to the following:

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A copy is also being sent on April 15, 2026, by email, to Aaron Szabo, U.S. EPA Assistant Administrator for the Office of Air and Radiation, at szabo.aaron@epa.gov.

Below is a list of accompanying appendices:

- Appendix A: Technical Memorandum on Modeling
- Appendix B: Technical Memorandum on the EPA Final Rule's Reliance on Global Average Temperature and Sea Level Rise Metrics
- Appendix C: Technical Memorandum on EPA's Final Rule Analysis of Variability and

Measurability

- Appendix D: Modeling the Sea-Level Change from U.S. Vehicle Emissions

In addition, we are submitting via email a link to access certain documents cited in this Petition, including the below:

- Michael Ablain et al., *Uncertainty in satellite estimates of global mean sea-level changes, trend and acceleration*. 11 Earth Sys. Science Data 1189 (2019), https://essd.copernicus.org/articles/11/1189/2019/.
- T.J. Ballinger et al., NOAA, *Arctic Report Card 2025: Surface Air Temperature* (Nov. 18, 2025), https://arctic.noaa.gov/report-card/report-card-2025/surface-air-temperature-2025/
- Josh Blumenfeld, *The Precision Behind Sea Level Rise,* NASA EarthData (last updated Jan. 16, 2025), https://www.earthdata.nasa.gov/news/feature-articles/precision-behind-sea-level-rise.
- John D. Boon et al., *Anthropocene Sea Level Change: A History of Recent Trends Observed in the U.S. East, Gulf, and West Coast Regions*, Va. Inst. of Marine Sci., Applied Marine Sci. and Ocean Eng'g, Spec. Rep. No. 467, at IV-2 (2018), https://scholarworks.wm.edu/entities/publication/fc099785-8ecc-47ec-9818-835ea9c8f19e.
- M.L. Druckenmiller et al., NOAA, *Arctic Report Card 2025: Executive Summary* (Dec. 23, 2025), https://doi.org/10.25923/NRZF-J897.
- Environmental Law & Policy Center, *An Assessment of the Impacts of Climate Change on the Great Lakes* (2019), https://elpc.org/wp-content/uploads/2020/04/2019-ELPCPublication-Great-Lakes-Climate-Change-Report.pdf
- Veronika Eyring et al., *Human Influence on the Climate System*, *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 (Valérie Masson-Delmotte et al. eds., 2021), https://www.ipcc.ch/report/ar6/wg1/chapter/chapter-3/.
- Thomas Frederikse et al., *The causes of sea-level rise since 1900*. 584 Nature 393 (2020) https://doi.org/10.1038/s41586-020-2591-3.
- Boyin Huang et al., *Uncertainty Estimates for Sea Surface Temperature and Land Surface Air Temperature in NOAAGlobalTemp Version 5*, 33 Journal of Climate 1351 (2020), https://doi.org/10.1175/JCLI-D-19-0395.1.
- Nathan J.L. Lenssen et al., *Improvements in the GISTEMP uncertainty model.* 124 J. of Geophysical Rsch.: Atmospheres 6307 (2019), https://doi.org/10.1029/2018JD029522.
- Nathan J.L. Lenssen et al., *A NASA GISTEMPv4 observational uncertainty ensemble*, 129 J. of Geophysical Rsch.: Atmospheres 1 (2024), https://doi.org/10.1029/2023JD040179.
- Kate Marvel et al., *Chapter 2: Climate Trends*, *in* Fifth National Climate Assessment (Allison R. Crimmins et al., eds., 2023), 2-4, https://toolkit.climate.gov/sites/default/files/2025-07/NCA5_Ch2_Climate-Trends.pdf.
- C.P. Morice et al., *An updated assessment of near-surface temperature change from 1850: the HadCRUT5 data set*, 126 J. of Geophysical Rsch.: Atmospheres 1 (Feb. 2021), https://doi.org/10.1029/2019JD032361.
- NASA, *Major Greenhouse Gas Sources, Lifespans, and Possible Added Heat* (June 22, 2023). https://science.nasa.gov/resource/graphic-major-greenhouse-gas-sources-lifespans-and-

possible-added-heat/

- NASA, *Global Mean Sea Level*, https://sealevel.nasa.gov/understanding-sea-level/key-indicators/global-mean-sea-level/ (last visited Apr. 14, 2026).
- NOAA, National Centers for Environmental Information, *Accounting for Natural Variability in Our Changing Climate* (Aug. 5, 2019), https://www.ncei.noaa.gov/news/accounting-natural-variability-our-changing-climate
- NOAA, National Centers for Environmental Information, *Climate at a Glance: Global Time Series,* https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series/globe/land_ocean/tavg/ytd/12/1950-2025 (last visited Apr. 15, 2026).
- Robert Rohde & Zeke Hausfather, *The Berkeley Earth Land/Ocean Temperature Record*, 12 Earth Syst. Sci. Data 3469 (2020) https://essd.copernicus.org/articles/12/3469/2020/.
- Robert Rohde, *Global Temperature Report for 2025*, Berkeley Earth (Jan. 14, 2026), https://berkeleyearth.org/global-temperature-report-for-2025/.
- William V. Sweet et al., NOAA, *Global and regional sea level rise scenarios for the United States: Technical Report NOS.01* 7 (Feb. 2022), https://earth.gov/sealevel/us/resources/2022-sea-level-rise-technical-report/.
- Sean Vitousek et al., *Doubling of coastal flooding frequency within decades due to sea-level rise*, 7 Sci. Rep. 1399 (2017), https://doi.org/10.1038/s41598-017-01362-7

The same link also contains additional documents supporting the Petition and the accompanying appendices, including:

- Modeling files and other documents relating to vehicle emissions inputs and FaIR modeling, supporting Appendix A.
- Analysis, datasets, and publications, supporting Appendix C.
- Modeling files and other documents related to BRICK modeling, supporting Appendix D.

APPENDIX A

Technical Memorandum on Modeling

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1. Introduction

This technical memorandum supports the petition filed by Environmental Defense Fund, Natural Resources Defense Council, et al. seeking reconsideration of EPA's final rule "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards," 91 Fed. Reg. 7,686 (Feb. 18, 2026).The Final Rule's futility rationale relied on entirely new modeling and other technical analyses that EPA performed after the period for public comment on the proposed rule closed. The novel technical analysis projects GHG emissions from US on-road vehicles and the impacts of such emissions on Global Mean Surface Temperature (GMST) and Global Sea Level Rise (GSLR). As we explain in the accompanying petition, EPA's futility analysis is arbitrary and capricious for many reasons. To address the errors in EPA's approach, EDF has conducted our own analysis. A description of the methodology and results of that analysis are presented below.

2. Vehicle Scenario Modeling

a. Recreating EPA's vehicle emission projections (Scenario A)

In order to critique EPA's futility analysis, we first needed to obtain EPA's emissions inputs, which in turn are used in the temperature and sea level rise modeling. Ordinarily, such emissions inputs and the relevant emissions modeling files are simply provided by the Agency. In this Final Rule, EPA also provided certain documentation and modeling files to accompany its Regulatory Impacts Analysis.[3] In support of its futility analysis, however, EPA provided extremely limited documentation. This documentation is insufficient for the public to reproduce EPA's results or to fully know what the Agency actually did.

First, although EPA purported to model total US vehicle GHG emissions from 2027 through 2100, EPA only provided CO2 emissions input data for 3 of those years: 2027, 2050, and 2100. In other words, EPA provided key numerical emissions data for only 4% of the years (3 out of 74 years) that it modeled, leaving it to the public to reconstruct emissions data for the remaining 96% of years (71 out of 74 years). EDF needed to recreate the annual emissions in order to model the temperature, sea level, and damages associated with EPA's scenario, which we term Scenario A in this memorandum.

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[3] *See, e.g.*, EPA, Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act Regulatory Impact Analysis, EPA-420-R-26-002 ("RIA"); EPA, Updated modeling assumptions and tools for "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act" Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31054 ("EPA Modeling Memo"); EPA, Projected Criteria, Air Toxics, and GHG Emissions Impacts for the "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act" Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31055 ("EPA Emissions Memo"). Commenters raised significant objections to EPA's draft Regulatory Impacts Analysis accompanying the proposal, demonstrating that such analysis was fundamentally flawed in many ways. This memorandum does not further address EPA's Regulatory Impacts Analysis.

Second, EPA purported to run two models to estimate vehicle emissions: OMEGA and MOVES5.R2. EPA's Temperature Memo (hereafter "Memo")[4] states that it used the same "OMEGA model version and inputs" as Scenario A1. EDF used the CO2 emission projections for light- and medium-duty vehicles (LMDVs) from the corresponding physical effects file in the "Modeling Memo Attachments" folder provided by the EPA Docket Center upon request.[5]

For heavy-duty emissions, EPA did not provide any modeling files. In the "Modeling Memo Attachments" folder, there is a file labeled "20251117_151129_hdp3_physical_effects.csv" but the file is blank and empty.[6] Instead, the Agency gave only a cursory, one sentence explanation of how it applied the MOVES model, claiming that "[e]missions of the same gases from on-road heavy-duty vehicles (HDV) are estimated using MOVES5.R1."[7] However, this explanation appears wrong. As described in the separate EPA Modeling Memo, MOVES5.R1 is the model for the No Action case and MOVES5.R2 is the model for the Action case. Given the context, we have assumed EPA meant MOVES5.R2 since that is the relevant model.

However, when we calculated the heavy-duty Class 4 to 8 CO2 emissions from MOVES5.R2, they did not match the three values EPA provided for 2027, 2050, and 2100. See Table 1 for the comparison of the emissions. We also assessed Class 2b-8 emissions, and they also do not match EPA's provided values. (Note that the table uses 2055 in lieu of 2100, as MOVES5.R2 does not model year 2100, and EPA asserts it held emissions constant between 2055 and 2100.)

Table 1: CO2 emissions for calendar years 2027, 2050, and 2055 from MOVES5.R2 by regulatory class (million metric tons)

RegClass	Reg Class Name	2027	2050	2055*
41	Class 2b/3	116	117	123
42	Class 4/5	30	27	28
46	Class 6/7	37	25	25
47	Class 8	337	327	337
48	Urban Bus	3	3	3
49	Gliders	4	0	0
	MOVES5.R2 Class 4-8	412	381	393
	MOVES5.R2 Class 2b-8	527	498	516
	EPA HDV Emissions from Memo	450	550	564

*The value EPA provides is for 2100. Since EPA states they held emissions constant between 2055 and 2100, this is also the emissions value EPA used for 2055.

[4] EPA, Technical Memo on: Temperature, CO2 Concentration, and Sea Level Rise Impacts of Greenhouse Gas Emissions from U.S. Motor Vehicles for the "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act" Final Rule, Docket No. EPA-HQ-OAR-2025-0194-31105 ("Memo").

[5] Memo at 1-2.
Documents attached to EPA Docket ID: EPA-HQ-OAR-2025-0194 provided by the EPA Docket Center upon request, file location within the folder \Modeling Memo Attachments\LMHDV\A1\20251117_151129_a1\20251117_151129_a1\20251117_151129_lmdv_physical_effects_by_annum.csv
From EPA's description, it is unclear if the Agency included CH4 and N2O in its modeling, and the Agency only appears to present results for CO2. We further explain this issue in the accompanying petition. For Scenario A, we only modeled CO2.

[6] Connected to EPA Docket ID: EPA-HQ-OAR-2025-0194, file location: \Modeling Memo Attachments\LMHDV\A1\20251117_151129_a1\20251117_151129_a1\20251117_151129_hdp3_physical_effects.csv

[7] Memo at 2.

MOVES5.R2 provides annual emissions. However, given we could not get the MOVES5.R2 emissions to match EPA's stated CO2 values, and given our objective of matching EPA's modeling for emissions as accurately as possible, we chose not to use the annual emissions produced by MOVES5.R2. Instead, we linearly interpolated emissions from 2027 to 2050. Because EPA states it held the emissions constant after 2055, we also linearly interpolated between 2050 and 2055 using the 2100 value as the 2055 value. In order to continue modeling EPA's scenario through 2200, we assumed flat emissions for Scenario A as EPA did between 2055 and 2100.

b. Additional vehicle emission scenarios (Scenarios B and C)

As we explain in the petition, EPA's modeling makes numerous erroneous and irrational choices. To address these errors, EDF modeled two additional scenarios, identified as Scenario B and Scenario C.

Scenario B ("Today's Fleet") assumes vehicle emissions do not improve further than where they are currently. All future model years are assumed to have the same per-vehicle emissions rate as approximately MY2025. We use MY2025 because this is the most recent year with sufficiently available reported data. Electric vehicle adoption rates remain constant.

Scenario C ("Pre-GHG Protection Fleet") assumes that U.S. vehicle fleet composition and per-vehicle emissions rates as of approximately the time of the 2009 Endangerment Finding extend in perpetuity, with total emissions increasing proportionally to VMT. This scenario attempts to remove the emission reductions that occurred since EPA began regulating onroad vehicle GHG emissions.

To model these two scenarios, EDF ran MOVES5.R2 to project the emissions of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) from all onroad vehicle classes[8] for calendar years 2009 through 2060 aggregated at both national and annual levels.[9] We split out GHG emissions for each calendar year by vehicle class,[10] model year (MY), and fuel type. EDF used MOVES5.R2 outputs for vehicle populations and vehicle miles travelled (VMT) for these same vehicle groupings.

Because MOVES5.R2 only allows modeling to 2060, we developed VMT growth rates that we used to model emissions in 2061 through 2200. EDF determined the average annual absolute growth in light-duty, medium-duty, and heavy-duty VMT between 2050 and 2060 in MOVES5.R2. We increased GHG emissions in 2061 and beyond using only these growth amounts. The annual VMT growth used was 0.38% of 2050 VMT for light-duty vehicles, 1.01% of 2050 VMT for medium-duty vehicles, and 0.67% of 2050 VMT for heavy-duty vehicles.[11]

[8] All onroad vehicle classes in MOVES5 are regClassID 11 through 49, or motorcycles through heavy-duty tractor trailers.

[9] GHG emissions are not as sensitive to climatic conditions as evaporative and some other exhaust emissions, like those of volatile organic compounds (VOC), which are dominated by cold start emissions. Therefore, GHG emissions using national and annual ambient temperatures produce reasonable estimates. Running MOVES5 using monthly averages is both substantially more time consuming and would produce only slightly higher emissions results, underscoring the conservative nature of our approach.

[10] In MOVES5.R2 these are defined as sourceID and regClassID and we refer to them throughout using vehicle class as shorthand.

[11] EDF assumed constant growth, not a growth rate. So the increase in VMT each year between 2061 and 2200 was the same absolute number increase in miles.

We next developed model year specific emissions factors for each of our two scenarios. For Scenario B, EDF modeled EV sales as constant at approximately current levels—10% for light-duty vehicles[12] (regClassID = 20 or 30), 2% for medium-duty vehicles (regClassID=41), and no ZEV sales for heavy-duty vehicles (regClassID>41).[13] We left GHG emissions per mile from internal combustion engine vehicles constant at their 2027 MOVES5.R2 levels but increased their portion of VMT to account for our assumed lower and constant ZEV levels (in the case of light- and medium-duty vehicles) or no ZEVs (in the case of heavy-duty vehicles).[14] In addition, by adjusting emissions in 2061 and later only through VMT growth, we ensure that average GHG emissions per mile likewise remain constant over this timeframe.

For Scenario C, we assumed no ZEVs in the fleet. To derive GHG emissions per mile from internal combustion engine vehicles, EDF compared GHG emission factors for model years 2007-2014 for each vehicle class and fuel combination and selected the model year with the highest level of CO2 emissions per mile ("circa 2009 emissions factor"). Because of the Great Recession, vehicle sales dropped significantly in 2008 and 2009. Compared to 2006, total vehicle sales in 2008 and 2009 were 21% and 38% lower, respectively.[15] Because the Great Recession likely changed the fleet make up, especially for light-duty vehicles (i.e., likely more sales of lower emitting small and cheaper cars and fewer higher emitting, more expensive SUVs), we chose the highest CO2 emissions rate for a range of years. Additionally, in the MOVES5 data, some of the MD and HD categories have a sharp uptick in emissions rate starting in MY2010 which appears to be an upgrade in methodology EPA used in MOVES5 to estimate emissions rather than a change in the actual vehicles. We believe using the higher values avails ourselves of the updates to MOVES and more accurately represents vehicles from around that time period.

We then applied the CO2, CH4, and N2O emission factors for the model year with the highest emissions to all 2009 and later model year vehicles.[16] As in Scenario B, we hold GHG emissions per mile from internal

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[12] We further apportioned the 10% EVs between Battery Electric Vehicles (BEVs), representing 8% of vehicles, and plug-in-hybrid electric vehicles (PHEVs), representing 2% of vehicles, using outputs of EPA's OMEGA compliance model. We assumed PHEVs would operate roughly two-thirds of the time on grid electricity, meaning a single PHEV effectively represents 67% of a BEV and 33% of an internal combustion engine vehicle. Thus, modeling a fleet in MOVES with 8% BEVs and 2% PHEVs, is equivalent to a fleet with 9.4% BEVs. The share of time PHEVs spend running on electricity is determined by the size of the battery. 67% represents a PHEV with a real world 50-mile electric range. This is likely higher than the current PHEV sales but data is sparse on electric range. Thus, we made a conservative assumption reflecting a slightly cleaner fleet than had we used a lower electric operation factor and yielding smaller projected emissions impacts attributable to U.S. vehicles.

[13] According to the Alliance for Automotive Innovation's Get Connected EV Quarterly Report for Q4 2025, EV sales in the US accounted for 9.6% of LD sales in 2025 with 1.7% PHEVs and 7.9% BEVs. There is less data available for MD and HD EV sales. For MDVs, EDF previously estimated MD EV sales at 6% using Atlas Public Policy and CALSTART data. See Comment submitted by Environmental Defense Fund (EDF) (Part 1 of 3), EPA-HQ-OAR-2025-0194-3046 ("EDF EF Tech Comments"). MOVES5.R2 projects MD EV sales at 0.6% of total new vehicles in 2027 rising to around 2% by around 2030. Given the uncertainty in the data, EDF chose 2% EV sales for MDVs. CALSTART's Zeroing in on Zero-Emission Trucks dashboard reports 2024 HD EV sales as 0.4% of total sales and for the first six months of 2025, that value dropped to 0.2%. For the sake of model simplicity, EDF estimated HD EV sales at 0%. https://www.autosinnovate.org/posts/papers-reports/Get%20Connected%20EV%20Quarterly%20Report%202025%20Q4.pdf https://calstart.org/zio-zets/#zet-dashboard

[14] To ensure GHG emissions per mile from conventional vehicles remained constant where we capped ZEV sales at levels lower than MOVES5.R2 would otherwise project, EDF multiplied the GHG emissions from each vehicle class-fuel-MY combination by the ratio of (1.0 minus our assumed light-, medium-, and heavy-duty ZEV sales described above) over (1.0 minus the ZEV sales level in MOVES5.R2). EDF determined the BEV and fuel cell vehicle (FCV) sales fractions for each vehicle class and MY in MOVES5.2 using the output from our MOVES5.R2 run (fuelTypeID=9).

[15] https://fred.stlouisfed.org/series/TOTALSA

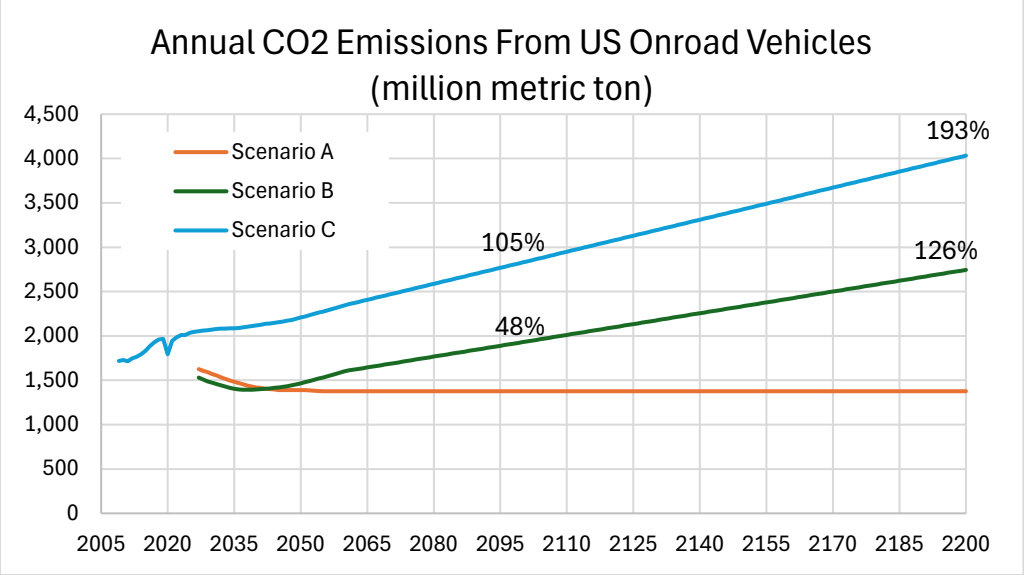
[16] We did this by multiplying the emissions of each vehicle class-fuel combination for model years 2009 and later by the ratio of the circa-2009 emission factor to the emission factor MOVES5.R2 projected for that model year. EDF did this for all the calendar years between 2009 and 2060.

combustion engine vehicles constant (though, in this case at circa-2009 levels) but increase their portion of VMT to account for the fact that Scenario C includes no ZEV sales in any of the vehicle classes.[17] The circa-2009 emission factors for selected vehicle class-fuel combinations are shown in Tables A1-A4 reproduced in the addendum to this memorandum.

As shown in Figure 1, the annual CO2 emissions for Scenario B is 48% higher in 2100 and 126% higher in 2200 compared to Scenario A. Scenario C annual CO2 emissions are more than double Scenario A in 2100 and nearly triple in 2200.

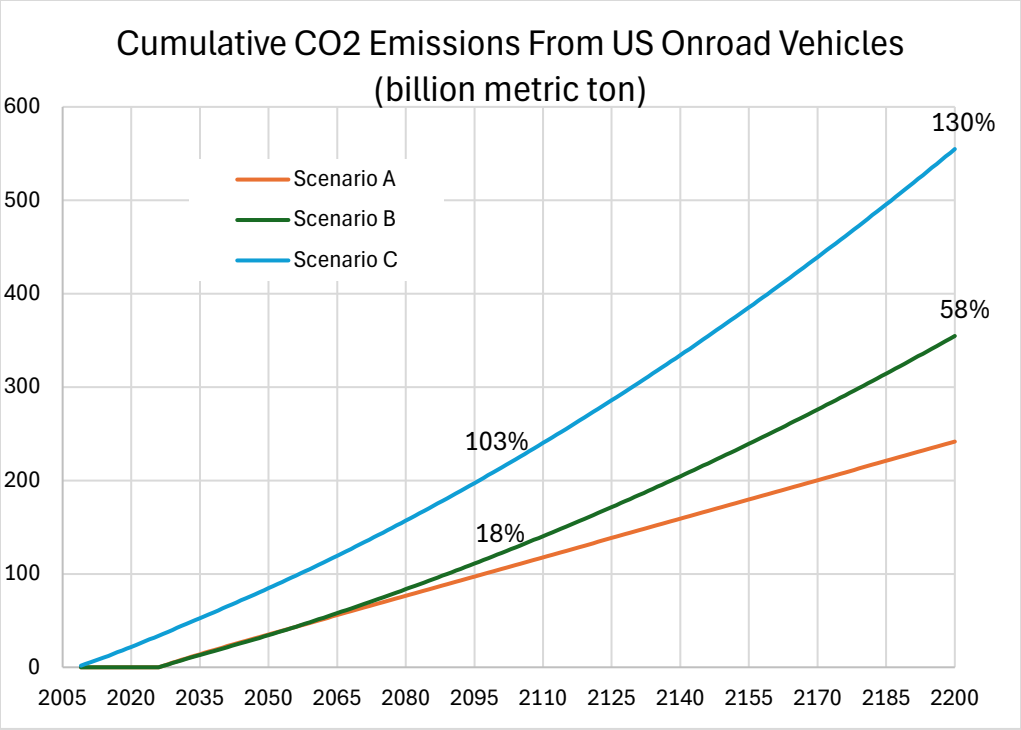
When comparing cumulative emissions (Figure 2), Scenario B is 18% higher in 2100 and 58% higher in 2200. Scenario C, when comparing cumulative emissions back to 2009, has more than double the CO2 emissions compared to Scenario A by 2100 and 130% higher cumulative emissions in 2200. Each year of emissions for CO2, CH4, and N2O are in Table A5 at the end of the memo.

Figure 1: Annual CO2 Emissions from U.S. Onroad Vehicles per Scenario



[17] Similar to our approach in Scenario B, described above, EDF divided the GHG emissions from each vehicle class-fuel-MY combination by (1.0 minus the ZEV sales level in MOVES5.2). This held the GHG emissions per mile from conventional vehicles at their circa-2009 MY levels, but increased their portion of VMT to account for no ZEV sales.

Figure 2: Cumulative CO2 Emissions from U.S. Onroad Vehicles per Scenario



c. Share of emissions from new vehicles for Scenario A

EDF calculated the share of emissions from new vehicles (MY2027+) for Scenario A (Table 2). We used MY and CY outputs from MOVES5.R2 to calculate the share of emissions from MY2027+ vehicles for calendar year 2027 through 2060. We summed the total emissions from MY2027+ vehicles for each calendar year and then divided that by the total emissions from all onroad vehicles. MOVES5 assumes all vehicles turnover within 41 years (year 0 to year 40). Since not all vehicles turned over by 2060, EDF assumed linear interpolation from 98.9% of all emissions from MY2027+ vehicles in 2060 to 100% in 2068.

Table 2: Share of annual and cumulative CO2 emissions from MY2027+ vehicles for Scenario A, cumulative relative to 2027

	Annual	Cumulative
2027	7.0%	7.0%
2030	26.6%	16.8%
2040	75.8%	43.6%
2050	94.3%	61.2%
2075	100.0%	80.2%
2100	100.0%	86.8%
2150	100.0%	92.1%
2200	100.0%	94.4%

The LMDV CO2 projections from OMEGA and MOVES5.R2 are slightly different but because OMEGA outputs do not provide a breakdown by MY and CY for the emissions, we used MOVES5.R2. The difference in the share of emissions from MY2027+ vehicles should be negligible.

3. Global Mean Surface Temperature (GMST) and Global Sea Level Rise (GSLR) modeling

As with EPA's emissions modeling, the Final Rule's modeling of temperature and sea level using FaIR and BRICK rise did not provide the public with sufficient information to reproduce the Agency's results. To begin with, EPA did not provide any of the modeling files for FaIR and BRICK, even though the Agency presumably used such files and had them in its possession. Nor did EPA provide many of the parameters required to run these models or even inform the public of the version of BRICK that the Agency used. Moreover, as already explained in the prior section, EPA did not provide the public with its emissions data or MOVES modeling files, and we did our best to reconstruct the inputs based on the scant documentation EPA provided. As a result of the Agency's lack of transparency for the emissions inputs, FaIR, and BRICK, we were unable to reproduce the exact temperature and sea level numbers presented in the Final Rule. Nonetheless, our Scenario A—which is meant to reproduce EPA's modeling—projected temperature and sea level impacts similar to and consistent with EPA's Final Rule. As explained further in the petition, we believe that comparing the results in Scenarios A-C reasonably illustrates EPA's failure to adequately account for the climate change impacts of US vehicle GHGs and the arbitrary nature of EPA's reliance on only one modeling scenario.

The framework EPA used to model the impact of US vehicle emissions was to run a scenario with global emissions based on SSP2-4.5 and then run a scenario where EPA removed US vehicle emissions from global emissions (i.e., subtracted US onroad vehicle CO2 from global CO2 emissions for each year). To calculate the "contribution" from US onroad vehicles, EPA subtracted the run without vehicles from the baseline run. We have replicated EPA's general framework. We ran four scenarios, Baseline and the Baseline minus Scenarios A, B, and C, respectively, for each of the modeling steps included below. For CO2 concentration, GMST, and GSLR, we present the results as EPA did: (1) the total global increase under SSP2-4.5 "Baseline", (2) the total global increase under SSP2-4.5 less the vehicle emissions "Minus Scen X GHG Emissions", and the contribution of the vehicle emissions calculated by subtracting (2) from (1). Table 3 details the global CO2, CH4, and N2O emissions and the US onroad vehicle emissions contribution for each scenario for a subset of years.

Table 3: Global GHG emissions (million metric tons/year) and contributions by scenario

	2009	2027	2050	2100	2150	2200
Global CO2[18]	31,459	39,633	42,961	14,483	9,655	4,924
Global CH4	364.2	396.0	357.2	295.2	237.5	180.9
Global N2O	10.55	11.94	12.59	8.73	8.21	7.70
Scenario A CO2	-	1,626	1,390	1,376	1,376	1,376
Scenario B CO2	-	1,529	1,467	1,930	2,337	2,744
Scenario B CH4	-	1.131	0.333	0.830	1.048	1.266
Scenario B N2O	-	0.077	0.074	0.094	0.118	0.142
Scenario B CO2e		1,553	1,495	1,978	2,398	2,818
Scenario C CO2	1,719	2,054	2,207	2,828	3,430	4,033
Scenario C CH4	0.250	0.223	0.546	1.325	1.670	2.016
Scenario C N2O	0.066	0.096	0.104	0.136	0.171	0.207
Scenario C CO2e	1,743	2,085	2,250	2,901	3,523	4,144

*CO2e values calculated with a global warming potential (GWP) on a 100-year time horizon based on the Fifth Assessment Report with the GWP for CH4 equal to 28 and N2O equal to 265.[19]

a. FaIR

i. FaIR Modeling

The Finite Amplitude Impulse Response (FaIR) model is a reduced-complexity, open-source climate model that translates greenhouse gas emissions into atmospheric concentrations, radiative forcing, and global temperature changes. EDF used FaIR v2.2.0, initialized over 1750-2200 with default species properties, emissions, and radiative forcing imported from RCMIP for the SSP2-4.5 scenario. A calibrated ensemble of parameter sets was imported (v1.4.1), and solar radiative forcing was modified to remain constant from 2022 onwards, consistent with what EPA appears to do based on the Memo. Custom emissions trajectories were imported and subtracted from the baseline emissions. All state variables were initialized to baseline conditions, and stochastic variability was enabled using configuration-specific parameters with unique seeds. Simulations were then executed across the full ensemble.

ii. FaIR Results

This section shows the results of running our baseline and three vehicle emissions scenarios in the FAIR model.

1. CO2 Concentration

The tables below show the estimated impact of U.S. vehicle emissions on global CO2 concentrations through 2200 and under the three scenarios.

Table 4 includes the estimated median CO2 concentrations from 2009 to 2200 for the baseline and each of the scenarios with the 95% confidence interval in parentheses.

[18] This is only fossil fuel CO2 emissions (FFI) and not Agriculture, Forestry, and Other Land Use (AFOLU) emissions.
[19] https://ghgprotocol.org/sites/default/files/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf

Table 4: Absolute global CO2 concentrations (ppm), by scenario. Median (95% confidence interval)

	Baseline	minus Scen. A veh. GHG emissions	minus Scen. B veh. GHG emissions	minus Scen. C veh. GHG emissions
2009	385.7 (384.5-387.2)	385.7 (384.5-387.2)	385.7 (384.5-387.2)	385.7 (384.5-387.2)
2027	433.6 (430.8-437.1)	433.6 (430.8-437.1)	433.6 (430.8-437.1)	430.6 (427.9-434.0)
2050	504.8 (499.0-512.8)	501.6 (495.9-509.4)	501.7 (496.0-509.5)	497.5 (491.9-505.1)
2100	599.7 (586.9-617.8)	590.0 (577.6-607.5)	588.3 (576.0-605.7)	580.2 (568.2-597.1)
2150	618.9 (603.1-642.9)	602.8 (587.8-625.6)	597.5 (582.8-620.0)	584.8 (570.8-606.3)
2200	634.4 (616.1-664.6)	611.9 (594.9-640.1)	601.1 (584.6-628.3)	583.0 (567.6-608.5)

Table 5 shows the change in global CO2 concentrations for Scenario A and Scenario B. As shown, Scenario B results in a greater increase in global median CO2 concentrations by 2100 than Scenario A and the gap continues to increase through 2200, by which time the vehicle emissions associated with Scenario B has resulted in a 33 ppm increase in CO2 concentrations compared to 23 ppm for the vehicle emissions associated with Scenario A.

Table 5: Change in global CO2 concentrations (ppm) relative to 2027 for Scenario A and B. Median (95% confidence interval) (% contribution)

	2027 Baseline	Scen. A contribution	Scen. B contribution
2050	+71.2 (68.2-75.6)	3.2 (3.1-3.3) (4.5%)	3.1 (3.0-3.3) (4.4%)
2100	+166.1 (156.0-180.7)	9.7 (9.3-10.4) (5.9%)	11.4 (10.9-12.1) (6.9%)
2150	+185.2 (172.2-205.8)	16.1 (15.2-17.3) (8.7%)	21.4 (20.3-23.0) (11.5%)
2200	+200.8 (185.2-227.4)	22.5 (21.2-24.5) (11.2%)	33.3 (31.4-36.3) (16.6%)

*% contribution calculated as the absolute contribution in each year divided by the absolute increase in the baseline in that year relative to 2027

Table 6 shows the impact of U.S. vehicle emissions on global median CO2 concentrations in Scenario C. By 2050, the contribution of U.S. vehicles to the global CO2 concentration increase since 2009 would be more than 6% and by 2200, that share would increase to over 20%.

Table 6: Change in global CO2 concentrations (ppm) relative to 2027 for Scenario C. Median (95% confidence interval) (% contribution)

	2009 Baseline	Scen C contribution
2027	+47.9 (46.4-49.9)	3.1 (3.0-3.1) (6.4%)
2050	+119.1 (114.6-125.5)	7.3 (7.1-7.7) (6.2%)
2100	+214.0 (202.4-230.6)	19.5 (18.6-20.8) (9.1%)
2150	+233.1 (218.6-255.7)	34.1 (32.3-36.6) (14.6%)
2200	+248.7 (231.6-277.3)	51.4 (48.4-56.1) (20.7%)

*% contribution calculated as the absolute contribution in each year divided by the absolute increase in the baseline in that year relative to 2009

2. Temperature

The tables below show the estimated impact of U.S. vehicle emissions on global mean surface temperature (GMST) through 2200 under the three vehicle emission scenarios.

Table 7 shows estimated temperatures between 2009 and 2200 relative to pre-industrial (1850-1900) temperatures for the baseline and each of the three scenarios, with the 95% confidence interval shown in parentheses.

Table 7: Global Mean Surface Temperature (deg C) relative to pre-industrial levels (1850-1900), by scenario. Projected median temperature (95% Confidence Interval)

	Baseline	minus Scen. A veh. GHG emissions	minus Scen. B veh. GHG emissions	minus Scen. C veh. GHG emissions
2009	0.871 (0.538-1.245)	0.871 (0.538-1.245)	0.871 (0.538-1.245)	0.871 (0.538-1.245)
2027	1.405 (0.937-1.961)	1.405 (0.937-1.961)	1.405 (0.937-1.961)	1.391 (0.926-1.943)
2050	1.983 (1.324-2.887)	1.969 (1.314-2.869)	1.969 (1.314-2.869)	1.947 (1.299-2.839)
2100	2.886 (1.850-4.405)	2.839 (1.821-4.340)	2.831 (1.816-4.329)	2.791 (1.789-4.264)
2150	3.201 (2.079-5.186)	3.120 (2.026-5.060)	3.096 (2.007-5.019)	3.026 (1.962-4.918)
2200	3.383 (2.170-5.823)	3.263 (2.097-5.659)	3.205 (2.061-5.572)	3.105 (1.994-5.405)

Table 8 shows the contribution in increased surface temperature relative to 2027 for Scenarios A and B. The table shows that Scenario A and Scenario B contribute to the same change in temperature in 2050, relative to a 2027 baseline. However, by 2100, and even more so by 2200, Scenario B temperature change is far higher than Scenario A.

Table 8: Change in Global Mean Surface Temperature (deg C) relative to 2027 for Scenarios A and B. Median (95% Confidence Interval) (% contribution)

	2027 Baseline	Scen. A contribution	Scen. B contribution
2050	+0.578 (0.387-0.926)	0.014 (0.010-0.020) (2.4%)	0.014 (0.010-0.020) (2.4%)
2100	+1.481 (0.914-2.443)	0.045 (0.031-0.065) (3.0%)	0.053 (0.036-0.077) (3.6%)
2150	+1.796 (1.142-3.225)	0.079 (0.053-0.119) (4.4%)	0.106 (0.071-0.157) (5.9%)
2200	+1.979 (1.233-3.861)	0.115 (0.076-0.179) (5.8%)	0.170 (0.113-0.260) (8.6%)

*% contribution calculated as the absolute contribution in each year divided by the absolute increase in the baseline in that year relative to 2027

Table 9 shows that if EPA had never adopted vehicle GHG emissions standards, climate emissions from the U.S. vehicle fleet could drive up global mean surface temperature by 0.094 degrees C in 2100 and 0.269 degrees C in 2200, or 10%, relative to a 2009 baseline. This is approximately 0.169 degrees F in 2100 and 0.484 degrees F in 2200.

Table 9: Change in Global Mean Surface Temperature (deg C) relative to 2009 for Scenario C. Median (95% Confidence Interval) (% contribution)

	2009 Baseline	Scen. C contribution
2027	+0.534 (0.399-0.717)	0.015 (0.011-0.020) (2.7%)
2050	+1.112 (0.786-1.643)	0.036 (0.025-0.051) (3.2%)
2100	+2.015 (1.313-3.160)	0.094 (0.064-0.138) (4.7%)
2150	+2.330 (1.541-3.941)	0.173 (0.115-0.259) (7.4%)
2200	+2.513 (1.632-4.578)	0.269 (0.178-0.414) (10.7%)

*% contribution calculated as the absolute contribution in each year divided by the absolute increase in the baseline in that year relative to 2009

EPA includes in the Final Rule an "illustrative 50%" scenario where the Agency divides all of the temperature and sea level contributions in half. As we explain in the petition, it is arbitrary to divide modeled contributions in half. Nonetheless, consistent with EPA's approach, we also present below the temperature impacts from our own modeling divided in half.

Table 10: Change in Global Mean Surface Temperature (deg C) relative to 2027 for **50%** of Scenarios A and B. Median (95% Confidence Interval) (% contribution)

	2027 Baseline	Scen. A contribution	Scen. B contribution
2050	+0.578 (0.387-0.926)	0.007 (0.005-0.010) (1.22%)	0.007 (0.005-0.010) (1.22%)
2100	+1.481 (0.914-2.443)	0.023 (0.015-0.033) (1.52%)	0.027 (0.018-0.038) (1.80%)
2150	+1.796 (1.142-3.225)	0.040 (0.026-0.060) (2.21%)	0.053 (0.035-0.079) (2.94%)
2200	+1.979 (1.233-3.861)	0.058 (0.038-0.090) (2.92%)	0.085 (0.057-0.130) (4.30%)

*% contribution calculated as the absolute contribution in each year divided by the absolute increase in the baseline in that year relative to 2027

Table 11: Change in Global Mean Surface Temperature (deg C) relative to 2009 for **50%** of Scenario C. Median (95% Confidence Interval) (% contribution)

	2009 Baseline	Scen. C contribution
2027	+0.534 (0.399-0.717)	0.007 (0.005-0.010) (1.37%)
2050	+1.112 (0.786-1.643)	0.018 (0.013-0.025) (1.64%)
2100	+2.015 (1.313-3.160)	0.047 (0.032-0.069) (2.34%)
2150	+2.330 (1.541-3.941)	0.086 (0.057-0.130) (3.71%)
2200	+2.513 (1.632-4.578)	0.134 (0.089-0.207) (5.35%)

*% contribution calculated as the absolute contribution in each year divided by the absolute increase in the baseline in that year relative to 2009

b. BRICK

The BRICK sea-level modeling was conducted by Tony Wong at Rochester Institute of Technology, one of the two original lead authors and current manager of the development of the model. The full explanation of his methodology and results are copied into Appendix D and can be found at https://arxiv.org/abs/2604.13446. Below we present select summary tables.

Table 12: Global Sea Level Rise (cm) relative to pre-industrial levels (1850-1900), by scenario. Median (95% Confidence Interval)

	Baseline	minus Scen. A veh. GHG emissions	minus Scen. B veh. GHG emissions	minus Scen. C veh. GHG emissions
2009	10.1 (6.0-15.3)	10.1 (6.0-15.3)	10.1 (6.0-15.3)	10.1 (6.0-15.3)
2027	15.6 (10.6-22.5)	15.6 (10.6-22.5)	15.6 (10.6-22.5)	15.5 (10.5-22.5)
2050	27.2 (18.4-53.6)	27.0 (18.4-53.5)	27.0 (18.4-53.5)	26.8 (18.3-52.2)
2100	91.3 (42.5-179.4)	89.7 (42.0-176.5)	89.5 (41.9-176.3)	87.5 (41.4-174.2)
2150	177.9 (68.6-330.0)	174.7 (67.2-324.9)	174.3 (66.9-323.8)	170.5 (65.7-318.5)
2200	268.5 (95.6-475.1)	260.4 (90.5-467.6)	259.1 (89.8-464.9)	252.6 (87.5-456.1)

Table 13: Change in Global Sea Level Rise (cm) relative to 2027 for Scenario A and B. Median (95% Confidence Interval) (% contribution)

	2027 Baseline	Scen A contribution	Scen B contribution
2050	+11.4 (6.0-32.7)	0.07 (0.04-1.04) (0.6%)	0.07 (0.04-1.03) (0.6%)
2100	+76.1 (29.9-160.7)	1.45 (0.40-5.16) (1.9%)	1.61 (0.44-5.82) (2.1%)
2150	+163.6 (55.4-309.3)	3.61 (1.16-12.73) (2.2%)	4.28 (1.43-17.32) (2.6%)
2200	+253.8 (82.1-454.1)	6.39 (2.35-21.18) (2.5%)	8.32 (3.12-29.34) (3.3%)

Table 14: Change in Global Sea Level Rise (cm) relative to 2009 for Scenario C. Median (95% Confidence Interval) (% contribution)

	2009 Baseline	Scen C contribution
2027	+5.5 (2.5-9.3)	0.04 (0.03-0.08) (0.72%)
2050	+17.0 (9.6-41.0)	0.29 (0.15-2.23) (1.7%)
2100	+81.0 (33.3-169.0)	3.57 (0.91-9.65) (4.4%)
2150	+167.8 (59.0-317.4)	8.25 (2.58-30.40) (4.9%)
2200	+260.5 (85.6-463.4)	14.37 (5.17-60.30) (5.5%)

As with temperature impacts, we observe significantly greater sea level rise impacts from Scenario B and C relative to Scenario A. For example, by 2100, we observe sea level rise of 1.61 cm and 3.57 cm in Scenario B and C, respectively, compared to only 1.45 cm in Scenario A (Tables 12, 13, 14). We observe the highest modeled sea level rise of 14.37 cm in 2200 in Scenario C, nearly ten times the 2100 projected impacts in Scenario A. 14.37 cm is approximately 5.66 inches, or nearly half a foot of sea level rise.

EPA includes in the Final Rule an "illustrative 50%" scenario where they divide all of the temperature and sea level contributions in half. As we explain in the petition, it is arbitrary to divide modeled contributions in half. Nonetheless, consistent with EPA's approach, we also present below the sea level rise impacts from our own modeling divided in half.

Table 15: Change in Global Sea Level Rise (cm) relative to 2027 for 50% of Scenario A and B. Median (95% Confidence Interval) (% contribution)

	2027 Baseline	Scen A contribution	Scen B contribution
2050	+11.4 (6.0-32.7)	0.04 (0.02-0.52) (0.30%)	0.04 (0.02-0.52) (0.30%)
2100	+76.1 (29.9-160.7)	0.73 (0.20-2.58) (0.95%)	0.81 (0.22-2.91) (1.05%)
2150	+163.6 (55.4-309.3)	1.81 (0.58-6.37) (1.10%)	2.14 (0.72-8.66) (1.30%)
2200	+253.8 (82.1-454.1)	3.20 (1.18-10.59) (1.25%)	4.16 (1.56-14.67) (1.65%)

Table 16: Change in Global Sea Level Rise (cm) relative to 2009 for 50% of Scenario C. Median (95% Confidence Interval) (% contribution)

	2009 Baseline	Scen C contribution
2027	+5.5 (2.5-9.3)	0.02 (0.02-0.04) (0.36%)
2050	+17.0 (9.6-41.0)	0.15 (0.08-1.12) (0.85%)
2100	+81.0 (33.3-169.0)	1.79 (0.46-4.83) (2.20%)
2150	+167.8 (59.0-317.4)	4.13 (1.29-15.20) (2.45%)
2200	+260.5 (85.6-463.4)	7.19 (2.59-30.15) (2.75%)

In addition to the global sea level modeling, Wong also preformed local sea level modeling to better understand how changes in sea level will impact American communities, specifically in the Gulf of Mexico. Further discussion of the methods are included in Appendix D and at https://arxiv.org/abs/2604.13446.

Given the limited time available to develop this modeling, and for ease of interpretation, only two of the FaIR-BRICK model runs were "downscaled" to understand their impacts at the local level: the "Maximum

Likelihood Estimate" (MLE), and the run with the median in 2100, "Med2100". The MLE is the simulation that we can think of as the simulation that best matches the historical sea-level observations. Med2100 is the simulation that yields the median global sea-level rise in the year 2100 in the baseline scenario. This "Med2100" simulation is significant because it is a middle-of-the-road outcome globally, where half the simulations project higher sea levels in 2100, and half project lower sea levels, making Med2100 a good summary of central tendency. Together, these two simulations provide a relatively simple and scientifically sound way to understand both a central outcome (Med2100) and a well-fitting, physically consistent outcome (MLE), without needing to examine hundreds of model simulations individually, which would have been infeasible in the limited time available.[20] Both MLE and Med2100, and the range between them, provide reasonable ways to understand the potential sea level rise impacts attributable the US vehicle emissions policy changes.

Table 17 below shows the MLE and Med2100 for the global baseline, the Gulf Coast baseline and for each of the three scenarios. Modeling of local sea level rise along the U.S. coast of the Gulf of Mexico demonstrates that the Gulf is projected to suffer substantially greater local sea level rise impacts than the global average. For example, assuming EPA's emissions inputs (Scenario A), we project that the impact of U.S. vehicle emissions on local sea level rise in the Gulf could reach 3.7 cm by 2100, far exceeding the global average impact of 1.45 cm. By 2200, we find that the impact on Gulf local sea level rise could rise up to 55.5 cm, considering a scenario where EPA never regulated vehicle GHGs (Scenario C). This is equivalent to 21.9 inches, or over 1.5 feet—a truly staggering amount of sea level rise.

Table 17: Baseline global mean sea level rise (GMSLR) and local mean sea level rise (LMSLR) for the U.S. Gulf of Mexico Coast (cm), shown relative to 2030 for consistency with how downscaling was done, which used a 10-year timestep. Gulf Coast baseline is the mean local mean sea level for all 178 US Gulf of Mexico coastal segments, relative to 2030, in each of the two downscaled simulations, MLE and Med2100. Scenarios A, B, and C are given as the reduction in LMSLR relative to the Gulf Coast baseline scenario.

	GMSLR relative to 2030		Gulf Coast baseline		Scenario A		Scenario B		Scenario C	
	MLE	Med2100	MLE	Med2100	MLE	Med2100	MLE	Med2100	MLE	Med2100
2050	11.2	8.76	12	12	0.1	0.1	0	0.1	0.2	0.2
2100	47.4	78.3	53	92	2.8	3.7	2.8	3.8	3.4	6.5
2150	106.2	164.3	121	190	12.5	4.8	15.1	5.1	20.9	8.7
2200	181.7	249.7	205	286	20.1	6.2	26.5	7.3	55.5	12.1

4. Damages modeling

In the novel futility analysis EPA conducted in the Final Rule, EPA only considered how US onroad vehicle GHG emissions would impact global mean surface temperature and global sea level rise. In doing so, EPA failed to consider how that temperature and sea level increase would directly impact Americans' public health and welfare. This section, we illustrate how EPA could have quantified damages through the social cost of GHGs (SC-GHGs). We present this analysis for Scenario A based on EPA's emissions inputs, as well as for the higher emissions values in the two additional Scenarios B and C described above. We also present a

[20] We believe EPA took the median projected value in each modeled year, from among the 841 simulations run in FaIR and BRICK. We believe that the MLE and Med2100 methods represent technically more robust ways to think about local sea level rise impacts, because they rely on a single, consistent simulation across all years. The location of the ice melt, Greenland or Antarctica, makes a large difference on the resulting local sea level rise because of the impacts of gravity. Using one consistent set of parameters ensures we do not jump half way through from an ensemble run with high levels of Greenland melt to a run with high levels of Antarctic melt which would mean very different outcomes for local sea level. To be consistent with EPA's approach, we also projected global sea level rise using the method we believe EPA used.

quantification of damages from Jessica Wentz based on a framework developed by Abram et al. These analyses further demonstrate that EPA cannot reasonably base its futility finding on the analysis in the Final Rule and that its finding is arbitrary and capricious.

The purpose of this analysis is to highlight that EPA's new futility methodology—of comparing proportional global mean surface temperature and global sea level rise projections to alleged and unsupported *de minimis* thresholds—is fundamentally absurd as it obscures the very thing for which EPA claims to rely on it: determining whether vehicle GHG emission standards have or could have meaningful impacts on U.S. health and welfare dangers from climate change. To the contrary, EPA's sole focus on the intermediate metrics of temperature and sea level masks massive and catastrophic impacts to human health and welfare endpoints. We do not intend this analysis to provide definitive quantifications of harm or to define specific modeling tools that EPA should have used.[21] These critiques are additional to the public comments, which presented robust demonstrations of the health and welfare harms from vehicle GHGs and the corresponding benefits of GHG emission standards.

a. Global Social Cost of GHGs

i. Methodology

EDF used the social cost of greenhouse gas estimates included in the November 2023 EPA's "Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances."[22] We calculated the social cost associated with CO2 for Scenario A and CO2, CH4, and N2O for Scenarios B and C. We converted the values into 2024$ and discounted all three scenarios to 2027.

ii. Results

Under a 2% discount rate, Tables 18 and 19 show that Scenario A would impose an estimated $23.3 trillion in global climate costs by 2200 while Scenario B would be even costlier at nearly $30 trillion. And if EPA had never adopted GHG emissions standards (Scenario C), the cost of global climate damages could reach $39 trillion by 2200 (Table 20).

Table 18: Climate Costs from Scenario A CO2 Emissions (trillion 2024$)

	2.50%	2.0%	1.5%
2050	$4.5	$7.3	$12.7
2100	$10.1	$17.6	$32.0
2150	$11.9	$21.7	$41.9
2200	$12.4	$23.3	$46.6

Table 19: Climate Costs from Scenario B CO2, CH4, and N2O Emissions (trillion 2024$)

	2.50%	2.0%	1.5%
2050	$4.4	$7.3	$12.6
2100	$11.5	$20.2	$37.1
2150	$14.3	$26.7	$52.5
2200	$15.3	$29.6	$61.3

[21] We are not providing new modeling of the other impacts of repealing the GHG program, such as increased fuel consumption or criteria pollutant harms. As commenters explained, those impacts are enormous and further demonstrate the benefits and reasonableness of the GHG program.

[22] EPA, Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, 2023. https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf

Table 20: Climate Costs from Scenario C CO2, CH4, and N2O Emissions (trillion 2024$)

	2.50%	2.0%	1.5%
2050	$6.5	$5.0	$9.0
2100	$16.9	$25.1	$47.4
2150	$21.1	$34.3	$69.1
2200	$22.5	$38.9	$81.5

b. Abram et al. Framework

Since the promulgation of the final rule, other experts have also examined EPA's futility analysis and concluded that EPA's emissions inputs and global mean surface temperature and global sea level rise changes are associated with massive health and welfare impacts. For example, Jessica Wentz (2026) published an analysis based on the quantification framework based on Abram et al. (2025) and concluded that the 0.037°C global mean surface temperature increase projected by EPA for 2100 corresponds with large concrete harms, including "(i) approximately 48.5 million additional people exposed to unprecedented extreme heat; (ii) approximately 33.4 million additional people left outside of the human climate niche, and (iii) the death of an additional ~ 1.5 billion coral colonies in the Great Barrier Reef during every future mass bleaching event."[23] This analysis, based on distinct methods, further shows that that EPA's analytical approach to futility arbitrarily obscures massive harms.[24]

[23] Jessica Wentz, Responding to EPA's Claim that U.S. Motor Vehicle Emissions Have a "De Minimis" Impact on Climate-Related Harms, *Climate Change: A Sabin Center Blog* (Feb. 20, 2026), https://blogs.law.columbia.edu/climatechange/2026/02/20/responding-to-epas-claim-that-u-s-motor-vehicle-emissions-have-a-de-minimis-impact-on-climate-related-harms/; Abram, N.J., Maher, N., Perkins-Kirkpatrick, S. *et al.* Quantifying the regional to global climate impacts of individual fossil fuel projects to inform decision-making. *npj Clim. Action* **4**, 92 (2025). https://doi.org/10.1038/s44168-025-00296-5.

[24] Another recent study highlighted how such assessing damages over the longer term, such as through the year 2300, provide a fuller accounting of damages. See Burke, M., Zahid, M., Diffenbaugh, N.S. et al. Quantifying climate loss and damage consistent with a social cost of carbon. Nature 651, 959–966 (2026). https://doi.org/10.1038/s41586-026-10272-6. This study further highlights that looking solely at global temperature and sea level rise impacts in the 2050 and 2100 timeframes can obscure the full harms to health and welfare.

Addendum A

Table A1: Circa-2009 GHG Emission Factors for Gasoline-Fueled Vehicles (g/mile)					
Model Year	sourceTypeID	RegClassID	CO2	Methane	N2O
2007	11	10	395	0.15	0.003
2007	21	20	390	0.02	0.006
2007	31	30	558	0.02	0.008
2007	32	30	548	0.02	0.008
2010	31	41	887	0.04	0.037
2010	32	41	907	0.04	0.037
2010	52	41	1103	0.04	0.100
2010	53	41	1046	0.02	0.022
2010	54	41	1114	0.03	0.020
2010	41	42	1912	0.08	0.033
2010	42	42	1829	0.07	0.030
2010	43	42	1368	0.05	0.035
2010	52	42	1183	0.08	0.100
2010	53	42	1115	0.03	0.022
2010	54	42	1199	0.05	0.020
2010	41	46	2033	0.10	0.033
2010	42	46	1947	0.09	0.030
2010	43	46	1501	0.06	0.035
2013	51	46	2092	0.09	0.007
2011	52	46	1495	0.09	0.027
2011	53	46	1388	0.04	0.006
2010	54	46	1493	0.07	0.020
2009	41	47	1618	0.05	0.033
2009	42	47	1547	0.05	0.030
2009	52	47	1499	0.09	0.100
2009	53	47	1387	0.03	0.022
2010	54	47	1881	0.09	0.020

Table A2: Circa-2009 GHG Emission Factors for Diesel Vehicles (g/mile)					
Model Year	sourceTypeID	RegClassID	CO2	Methane	N2O
2009	21	20	425	0.09	0.001
2007	31	30	791	0.10	0.001
2007	32	30	779	0.10	0.001
2009	31	41	828	0.09	0.015
2009	32	41	846	0.09	0.016
2009	52	41	1149	0.13	0.021
2009	53	41	1070	0.07	0.020
2009	54	41	1186	0.07	0.022
2010	41	42	1549	0.06	0.213
2010	42	42	1510	0.05	0.208
2009	43	42	1254	0.08	0.023
2009	52	42	1172	0.13	0.022
2009	53	42	1093	0.07	0.021
2009	54	42	1192	0.07	0.022
2010	41	46	1773	0.05	0.244
2010	42	46	1719	0.05	0.236
2010	43	46	1365	0.04	0.187
2010	51	46	1829	0.05	0.252
2010	52	46	1321	0.07	0.181
2010	53	46	1234	0.03	0.170
2010	54	46	1323	0.04	0.182
2010	61	46	1839	0.05	0.253
2007	62	46	1764	0.12	0.033
2010	41	47	1896	0.10	0.261
2010	43	47	1489	0.08	0.204
2010	51	47	1962	0.09	0.270
2010	52	47	1615	0.12	0.221
2010	53	47	1505	0.07	0.207
2010	54	47	1610	0.08	0.221
2010	61	47	1971	0.08	0.272
2010	62	47	1969	0.07	0.268
2010	42	48	1818	0.09	0.250
2010	61	49	1855	0.00	0.003
2010	62	49	1865	0.00	0.002

Table A3: Circa-2009 GHG Emission Factors for CNG-Fueled Vehicles (g/mile)					
Model Year	sourceTypeID	RegClassID	CO2	Methane	N2O
2010	41	47	1697	29.06	0.115
2010	43	47	1352	25.00	0.125
2010	51	47	1785	30.31	0.091
2010	52	47	1486	27.74	0.368
2010	53	47	1394	25.48	0.077
2010	61	47	1705	22.93	0.078
2012	62	47	1669	18.57	0.040
2010	42	48	1616	25.83	0.106

Table A4: Circa-2009 GHG Emission Factors for E85-Fueled Vehicles (g/mile)					
Model Year	sourceTypeID	RegClassID	CO2	Methane	N2O
2007	21	20	381	0.04	0.006
2007	31	30	546	0.04	0.008
2007	32	30	536	0.04	0.008

Table A5: Annual CO2, CH4, N2O and CO2e emissions from US onroad vehicles

All units million metric tons

	Scen A	Scen B				Scen C			
	CO2	CO2	CH4	N2O	CO2e	CO2	CH4	N2O	CO2e
2009						1,719	0.250	0.066	1,743
2010						1,730	0.232	0.064	1,753
2011						1,714	0.221	0.064	1,737
2012						1,748	0.205	0.066	1,772
2013						1,765	0.198	0.068	1,788
2014						1,792	0.195	0.071	1,817
2015						1,835	0.193	0.073	1,860
2016						1,889	0.195	0.078	1,915
2017						1,928	0.192	0.080	1,955
2018						1,959	0.192	0.082	1,986
2019						1,965	0.188	0.083	1,992
2020						1,795	0.167	0.081	1,821
2021						1,945	0.181	0.089	1,974
2022						1,985	0.190	0.090	2,014
2023						2,010	0.191	0.091	2,039
2024						2,009	0.198	0.092	2,039
2025						2,033	0.208	0.093	2,064
2026						2,045	0.215	0.094	2,076
2027	1,626	1,529	0.131	0.1	1,553	2,054	0.223	0.096	2,085
2028	1,606	1,507	0.134	0.077	1,532	2,059	0.229	0.096	2,091
2029	1,591	1,488	0.137	0.077	1,513	2,065	0.235	0.097	2,097
2030	1,572	1,472	0.140	0.077	1,497	2,072	0.239	0.098	2,105
2031	1,554	1,457	0.145	0.077	1,482	2,078	0.244	0.098	2,111

2032	1,533	1,442	0.150	0.077	1,467	2,081	0.250	0.099	2,114
2033	1,518	1,427	0.154	0.076	1,452	2,082	0.255	0.099	2,116
2034	1,499	1,416	0.158	0.076	1,440	2,085	0.261	0.099	2,119
2035	1,485	1,406	0.162	0.075	1,430	2,086	0.267	0.099	2,120
2036	1,468	1,398	0.164	0.075	1,423	2,089	0.273	0.100	2,123
2037	1,454	1,395	0.168	0.075	1,419	2,095	0.280	0.100	2,130
2038	1,441	1,394	0.173	0.075	1,419	2,103	0.289	0.100	2,137
2039	1,430	1,395	0.179	0.075	1,419	2,110	0.300	0.101	2,145
2040	1,420	1,398	0.187	0.074	1,423	2,119	0.315	0.101	2,155
2041	1,414	1,401	0.195	0.074	1,426	2,127	0.331	0.101	2,163
2042	1,405	1,405	0.205	0.074	1,431	2,135	0.350	0.101	2,172
2043	1,399	1,409	0.215	0.074	1,435	2,142	0.369	0.102	2,179
2044	1,395	1,413	0.227	0.074	1,439	2,147	0.390	0.102	2,185
2045	1,391	1,419	0.241	0.074	1,445	2,154	0.412	0.102	2,193
2046	1,389	1,426	0.256	0.074	1,452	2,162	0.435	0.102	2,201
2047	1,389	1,434	0.273	0.074	1,461	2,171	0.459	0.102	2,211
2048	1,388	1,443	0.292	0.074	1,471	2,181	0.485	0.103	2,222
2049	1,390	1,454	0.312	0.074	1,483	2,194	0.514	0.103	2,236
2050	1,390	1,467	0.333	0.074	1,495	2,207	0.546	0.104	2,250
2051	1,388	1,479	0.356	0.074	1,508	2,220	0.581	0.104	2,264
2052	1,385	1,491	0.380	0.074	1,522	2,234	0.618	0.105	2,279
2053	1,383	1,504	0.406	0.074	1,535	2,247	0.659	0.105	2,293
2054	1,380	1,518	0.433	0.074	1,550	2,261	0.703	0.105	2,309
2055	1,376	1,531	0.463	0.075	1,564	2,275	0.751	0.106	2,324
2056	1,376	1,545	0.496	0.075	1,579	2,289	0.802	0.106	2,340
2057	1,376	1,560	0.531	0.075	1,594	2,303	0.858	0.107	2,355
2058	1,376	1,574	0.570	0.075	1,610	2,317	0.917	0.107	2,371
2059	1,376	1,589	0.611	0.075	1,626	2,332	0.981	0.107	2,388
2060	1,376	1,604	0.655	0.075	1,642	2,346	1.048	0.107	2,404
2061	1,376	1,612	0.659	0.076	1,650	2,358	1.055	0.108	2,416
2062	1,376	1,620	0.664	0.076	1,659	2,370	1.062	0.109	2,429
2063	1,376	1,628	0.668	0.076	1,667	2,382	1.069	0.110	2,441
2064	1,376	1,636	0.672	0.077	1,676	2,394	1.076	0.110	2,454
2065	1,376	1,644	0.677	0.077	1,684	2,406	1.083	0.111	2,466
2066	1,376	1,653	0.681	0.078	1,692	2,418	1.090	0.112	2,479
2067	1,376	1,661	0.686	0.078	1,701	2,431	1.097	0.112	2,491
2068	1,376	1,669	0.690	0.079	1,709	2,443	1.103	0.113	2,503
2069	1,376	1,677	0.694	0.079	1,718	2,455	1.110	0.114	2,516
2070	1,376	1,685	0.699	0.080	1,726	2,467	1.117	0.115	2,528
2071	1,376	1,693	0.703	0.080	1,734	2,479	1.124	0.115	2,541
2072	1,376	1,701	0.707	0.081	1,743	2,491	1.131	0.116	2,553
2073	1,376	1,710	0.712	0.081	1,751	2,503	1.138	0.117	2,566
2074	1,376	1,718	0.716	0.082	1,760	2,515	1.145	0.117	2,578

2075	1,376	1,726	0.720	0.082	1,768	2,527	1.152	0.118	2,590
2076	1,376	1,734	0.725	0.083	1,776	2,539	1.159	0.119	2,603
2077	1,376	1,742	0.729	0.083	1,785	2,551	1.166	0.120	2,615
2078	1,376	1,750	0.734	0.084	1,793	2,563	1.173	0.120	2,628
2079	1,376	1,759	0.738	0.084	1,802	2,575	1.179	0.121	2,640
2080	1,376	1,767	0.742	0.085	1,810	2,587	1.186	0.122	2,653
2081	1,376	1,775	0.747	0.085	1,818	2,599	1.193	0.122	2,665
2082	1,376	1,783	0.751	0.086	1,827	2,611	1.200	0.123	2,677
2083	1,376	1,791	0.755	0.086	1,835	2,623	1.207	0.124	2,690
2084	1,376	1,799	0.760	0.087	1,843	2,635	1.214	0.124	2,702
2085	1,376	1,807	0.764	0.087	1,852	2,647	1.221	0.125	2,715
2086	1,376	1,816	0.769	0.088	1,860	2,659	1.228	0.126	2,727
2087	1,376	1,824	0.773	0.088	1,869	2,671	1.235	0.127	2,740
2088	1,376	1,832	0.777	0.089	1,877	2,683	1.242	0.127	2,752
2089	1,376	1,840	0.782	0.089	1,885	2,696	1.249	0.128	2,764
2090	1,376	1,848	0.786	0.089	1,894	2,708	1.255	0.129	2,777
2091	1,376	1,856	0.790	0.090	1,902	2,720	1.262	0.129	2,789
2092	1,376	1,864	0.795	0.090	1,911	2,732	1.269	0.130	2,802
2093	1,376	1,873	0.799	0.091	1,919	2,744	1.276	0.131	2,814
2094	1,376	1,881	0.803	0.091	1,927	2,756	1.283	0.132	2,827
2095	1,376	1,889	0.808	0.092	1,936	2,768	1.290	0.132	2,839
2096	1,376	1,897	0.812	0.092	1,944	2,780	1.297	0.133	2,851
2097	1,376	1,905	0.817	0.093	1,953	2,792	1.304	0.134	2,864
2098	1,376	1,913	0.821	0.093	1,961	2,804	1.311	0.134	2,876
2099	1,376	1,921	0.825	0.094	1,969	2,816	1.318	0.135	2,889
2100	1,376	1,930	0.830	0.094	1,978	2,828	1.325	0.136	2,901
2101	1,376	1,938	0.834	0.095	1,986	2,840	1.332	0.137	2,914
2102	1,376	1,946	0.838	0.095	1,995	2,852	1.338	0.137	2,926
2103	1,376	1,954	0.843	0.096	2,003	2,864	1.345	0.138	2,938
2104	1,376	1,962	0.847	0.096	2,011	2,876	1.352	0.139	2,951
2105	1,376	1,970	0.851	0.097	2,020	2,888	1.359	0.139	2,963
2106	1,376	1,979	0.856	0.097	2,028	2,900	1.366	0.140	2,976
2107	1,376	1,987	0.860	0.098	2,037	2,912	1.373	0.141	2,988
2108	1,376	1,995	0.865	0.098	2,045	2,924	1.380	0.142	3,001
2109	1,376	2,003	0.869	0.099	2,053	2,936	1.387	0.142	3,013
2110	1,376	2,011	0.873	0.099	2,062	2,949	1.394	0.143	3,025
2111	1,376	2,019	0.878	0.100	2,070	2,961	1.401	0.144	3,038
2112	1,376	2,027	0.882	0.100	2,079	2,973	1.408	0.144	3,050
2113	1,376	2,036	0.886	0.101	2,087	2,985	1.414	0.145	3,063
2114	1,376	2,044	0.891	0.101	2,095	2,997	1.421	0.146	3,075
2115	1,376	2,052	0.895	0.102	2,104	3,009	1.428	0.147	3,088
2116	1,376	2,060	0.899	0.102	2,112	3,021	1.435	0.147	3,100
2117	1,376	2,068	0.904	0.103	2,121	3,033	1.442	0.148	3,112

2118	1,376	2,076	0.908	0.103	2,129	3,045	1.449	0.149	3,125
2119	1,376	2,084	0.913	0.103	2,137	3,057	1.456	0.149	3,137
2120	1,376	2,093	0.917	0.104	2,146	3,069	1.463	0.150	3,150
2121	1,376	2,101	0.921	0.104	2,154	3,081	1.470	0.151	3,162
2122	1,376	2,109	0.926	0.105	2,163	3,093	1.477	0.152	3,175
2123	1,376	2,117	0.930	0.105	2,171	3,105	1.484	0.152	3,187
2124	1,376	2,125	0.934	0.106	2,179	3,117	1.490	0.153	3,199
2125	1,376	2,133	0.939	0.106	2,188	3,129	1.497	0.154	3,212
2126	1,376	2,141	0.943	0.107	2,196	3,141	1.504	0.154	3,224
2127	1,376	2,150	0.947	0.107	2,205	3,153	1.511	0.155	3,237
2128	1,376	2,158	0.952	0.108	2,213	3,165	1.518	0.156	3,249
2129	1,376	2,166	0.956	0.108	2,221	3,177	1.525	0.156	3,262
2130	1,376	2,174	0.961	0.109	2,230	3,189	1.532	0.157	3,274
2131	1,376	2,182	0.965	0.109	2,238	3,201	1.539	0.158	3,286
2132	1,376	2,190	0.969	0.110	2,247	3,214	1.546	0.159	3,299
2133	1,376	2,198	0.974	0.110	2,255	3,226	1.553	0.159	3,311
2134	1,376	2,207	0.978	0.111	2,263	3,238	1.560	0.160	3,324
2135	1,376	2,215	0.982	0.111	2,272	3,250	1.566	0.161	3,336
2136	1,376	2,223	0.987	0.112	2,280	3,262	1.573	0.161	3,349
2137	1,376	2,231	0.991	0.112	2,289	3,274	1.580	0.162	3,361
2138	1,376	2,239	0.996	0.113	2,297	3,286	1.587	0.163	3,373
2139	1,376	2,247	1.000	0.113	2,305	3,298	1.594	0.164	3,386
2140	1,376	2,256	1.004	0.114	2,314	3,310	1.601	0.164	3,398
2141	1,376	2,264	1.009	0.114	2,322	3,322	1.608	0.165	3,411
2142	1,376	2,272	1.013	0.115	2,331	3,334	1.615	0.166	3,423
2143	1,376	2,280	1.017	0.115	2,339	3,346	1.622	0.166	3,436
2144	1,376	2,288	1.022	0.116	2,347	3,358	1.629	0.167	3,448
2145	1,376	2,296	1.026	0.116	2,356	3,370	1.636	0.168	3,460
2146	1,376	2,304	1.030	0.116	2,364	3,382	1.643	0.169	3,473
2147	1,376	2,313	1.035	0.117	2,372	3,394	1.649	0.169	3,485
2148	1,376	2,321	1.039	0.117	2,381	3,406	1.656	0.170	3,498
2149	1,376	2,329	1.044	0.118	2,389	3,418	1.663	0.171	3,510
2150	1,376	2,337	1.048	0.118	2,398	3,430	1.670	0.171	3,523
2151	1,376	2,345	1.052	0.119	2,406	3,442	1.677	0.172	3,535
2152	1,376	2,353	1.057	0.119	2,414	3,454	1.684	0.173	3,547
2153	1,376	2,361	1.061	0.120	2,423	3,467	1.691	0.174	3,560
2154	1,376	2,370	1.065	0.120	2,431	3,479	1.698	0.174	3,572
2155	1,376	2,378	1.070	0.121	2,440	3,491	1.705	0.175	3,585
2156	1,376	2,386	1.074	0.121	2,448	3,503	1.712	0.176	3,597
2157	1,376	2,394	1.078	0.122	2,456	3,515	1.719	0.176	3,610
2158	1,376	2,402	1.083	0.122	2,465	3,527	1.725	0.177	3,622
2159	1,376	2,410	1.087	0.123	2,473	3,539	1.732	0.178	3,634
2160	1,376	2,418	1.092	0.123	2,482	3,551	1.739	0.179	3,647

2161	1,376	2,427	1.096	0.124	2,490	3,563	1.746	0.179	3,659
2162	1,376	2,435	1.100	0.124	2,498	3,575	1.753	0.180	3,672
2163	1,376	2,443	1.105	0.125	2,507	3,587	1.760	0.181	3,684
2164	1,376	2,451	1.109	0.125	2,515	3,599	1.767	0.181	3,697
2165	1,376	2,459	1.113	0.126	2,524	3,611	1.774	0.182	3,709
2166	1,376	2,467	1.118	0.126	2,532	3,623	1.781	0.183	3,721
2167	1,376	2,475	1.122	0.127	2,540	3,635	1.788	0.184	3,734
2168	1,376	2,484	1.126	0.127	2,549	3,647	1.795	0.184	3,746
2169	1,376	2,492	1.131	0.128	2,557	3,659	1.801	0.185	3,759
2170	1,376	2,500	1.135	0.128	2,566	3,671	1.808	0.186	3,771
2171	1,376	2,508	1.140	0.129	2,574	3,683	1.815	0.186	3,784
2172	1,376	2,516	1.144	0.129	2,582	3,695	1.822	0.187	3,796
2173	1,376	2,524	1.148	0.129	2,591	3,707	1.829	0.188	3,808
2174	1,376	2,533	1.153	0.130	2,599	3,719	1.836	0.188	3,821
2175	1,376	2,541	1.157	0.130	2,608	3,732	1.843	0.189	3,833
2176	1,376	2,549	1.161	0.131	2,616	3,744	1.850	0.190	3,846
2177	1,376	2,557	1.166	0.131	2,624	3,756	1.857	0.191	3,858
2178	1,376	2,565	1.170	0.132	2,633	3,768	1.864	0.191	3,871
2179	1,376	2,573	1.175	0.132	2,641	3,780	1.871	0.192	3,883
2180	1,376	2,581	1.179	0.133	2,650	3,792	1.877	0.193	3,895
2181	1,376	2,590	1.183	0.133	2,658	3,804	1.884	0.193	3,908
2182	1,376	2,598	1.188	0.134	2,666	3,816	1.891	0.194	3,920
2183	1,376	2,606	1.192	0.134	2,675	3,828	1.898	0.195	3,933
2184	1,376	2,614	1.196	0.135	2,683	3,840	1.905	0.196	3,945
2185	1,376	2,622	1.201	0.135	2,692	3,852	1.912	0.196	3,958
2186	1,376	2,630	1.205	0.136	2,700	3,864	1.919	0.197	3,970
2187	1,376	2,638	1.209	0.136	2,708	3,876	1.926	0.198	3,982
2188	1,376	2,647	1.214	0.137	2,717	3,888	1.933	0.198	3,995
2189	1,376	2,655	1.218	0.137	2,725	3,900	1.940	0.199	4,007
2190	1,376	2,663	1.223	0.138	2,734	3,912	1.947	0.200	4,020
2191	1,376	2,671	1.227	0.138	2,742	3,924	1.954	0.201	4,032
2192	1,376	2,679	1.231	0.139	2,750	3,936	1.960	0.201	4,045
2193	1,376	2,687	1.236	0.139	2,759	3,948	1.967	0.202	4,057
2194	1,376	2,695	1.240	0.140	2,767	3,960	1.974	0.203	4,069
2195	1,376	2,704	1.244	0.140	2,776	3,972	1.981	0.203	4,082
2196	1,376	2,712	1.249	0.141	2,784	3,984	1.988	0.204	4,094
2197	1,376	2,720	1.253	0.141	2,792	3,997	1.995	0.205	4,107
2198	1,376	2,728	1.257	0.142	2,801	4,009	2.002	0.206	4,119
2199	1,376	2,736	1.262	0.142	2,809	4,021	2.009	0.206	4,132
2200	1,376	2,744	1.266	0.142	2,818	4,033	2.016	0.207	4,144

APPENDIX B

Technical Memorandum on the EPA Final Rule's Reliance on Global Average Temperature and Sea Level Rise Metrics

L. Delta Merner, Carly A. Phillips, Carlos Martinez and Rachel Cleetus
Union of Concerned Scientists

Memo Outline:

1) Introduction
2) Limitations of Averaging Over Spatial Scales
3) Limitations of Averaging Over Temporal Scales
4) Limitations of Ignoring Non-Linearities
5) Global Average Temperatures are the Wrong Metric for Health Impacts
6) Summary

I. Introduction

This technical memorandum supports the petition filed by Environmental Defense Fund, Natural Resources Defense Council, et al. seeking reconsideration of EPA's final rule "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards," 91 Fed. Reg. 7,686 (Feb. 18, 2026). This memo examines how EPA's recent use of global mean surface temperature (GMST) and global mean sea level (GMSL) as the only metrics to assess the impacts of climate change is contrary to the scientific consensus which shows that seemingly "small" increases in GMST and GMSL translate into profound, non-linear, and compounding[1] risks for the human health and welfare of Americans. We highlight that: (1) global average temperatures and global mean sea level rise do not account for regional variations in the U.S., which in many cases are much higher than global averages; (2) global average temperatures mask true risks to people's health and well-being because they fail to take into account climate-driven temperature extremes such as heatwaves, which are increasing in frequency and duration and are a known driver of climate-related morbidity and mortality; and (3) overlapping climate impacts can lead to compounding and cascading impacts that magnify risks to people's health and welfare—interactions that are often obscured by mean global temperature and sea level values.

Drawing on recent data, scientific reports, and peer-reviewed literature, we demonstrate that global averages obscure critical regional disparities that impact communities and economies across the country. For example, the U.S. East and Gulf Coasts are experiencing accelerating sea-level rise

[1] Singh D. et al. 2023. Focus on compound events. In Fifth National Climate Assessment. Crimmins A.R. et al (eds) USGCRP, Washington, DC, USA.

rates that significantly exceed the global mean due to ocean dynamic changes and land subsidence.[2,3] Simultaneously, many regions of the United States are warming faster than the global average, such as arctic Alaska, which has warmed at three times the global rate since 1980,[4] driving cascading ecological and infrastructural failures.[5] New England in the Northeast U.S. is also warming much more and faster than most parts of the world.[6,7] Furthermore, reliance on GMST and GMSL metrics fails to capture the intensification of local extreme weather events—hurricanes, droughts, and floods—which serve as the primary vectors for health impacts and economic disruption from climate change.[8,9,10,11] Studies also show that compounding and cascading climate risks, including those from extreme heat and sea level rise, worsen impacts on human health infrastructure and the economy.[12,13] **We argue that relying solely on global averages is a fundamentally flawed way to estimate the threat to the health and welfare of people in the U.S. and the benefits of limiting those threats.**

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[13] Ebi, Kristie L. 2025. "Understanding the Risks of Compound Climate Events and Cascading Risks." *Dialogues on Climate Change* 2 (1): 33–37. https://doi.org/10.1177/29768659241304857.

II. Limitations of Averaging Over Spatial Scales

The most significant flaw in using global averages to assess U.S. risk is the assumption of uniformity with regards to both GMST and GMSL. Sea level is not a flat bathtub that rises evenly everywhere.[14,15] It is a dynamic surface influenced by gravity, ocean currents, wind patterns, and vertical land motion. Further complicating this, the relationship between sea level and temperature is non-linear, and the rate of SLR has been accelerating faster than predicted due to thermal expansion and accelerating land ice loss.[16] Consequently, the U.S. coastline is experiencing rates of change that diverge sharply from the global mean (Fig. 1).[17,18]

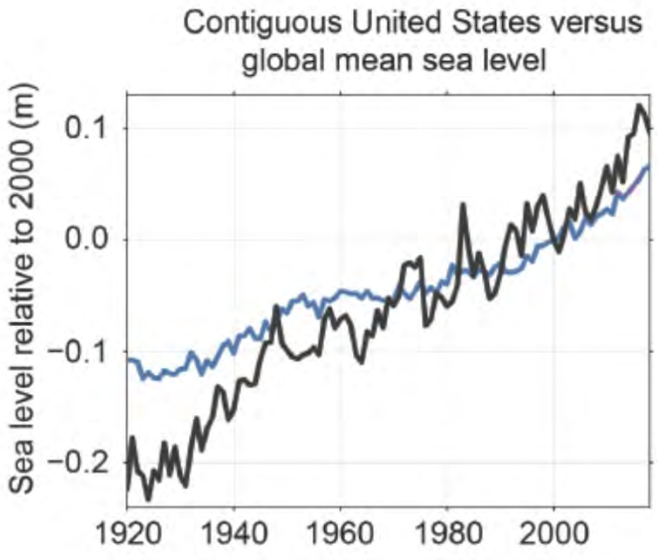

Figure 1 - GMSL change (blue line) as shown in a) with the annual average relative sea level change measured by tide gauges around the contiguous United States (black line; with a linear regression estimate of 28 cm of sea level rise from 1920 to 2020).[19,20]

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[14] NASA Sea Level Change. n.d. "Are Sea Levels Rising the Same All over the World, as If We're Filling a Giant Bathtub?" https://sealevel.nasa.gov/faq/9/are-sea-levels-rising-the-same-all-over-the-world-as-if-were-filling-a-giant-bathtub/.

[15] Fasullo, John T., and R. Steven Nerem. 2018. "Altimeter-Era Emergence of the Patterns of Forced Sea-Level Rise in Climate Models and Implications for the Future." *Proceedings of the National Academy of Sciences* 115 (51): 12944–49. https://doi.org/10.1073/pnas.1813233115.

[16] Druckenmiller, et al. *Arctic Report Card.*

[17] Fasullo, et al. *Altimeter-Era.*

[18] May, Christine L., Mark S. Osler, Hilary F. Stockdon, et al. 2023. *Chapter 9 : Coastal Effects. Fifth National Climate Assessment*. Edited by Allison R. Crimmins, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, Brooke C. Stewart, and Thomas K. Maycock. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023.CH9.

[19] Sweet et al. 2022. *Global and Regional Sea Level Rise.*

[20] Frederikse, Thomas, Felix Landerer, Lambert Caron, et al. 2020. "The Causes of Sea-Level Rise since 1900." *Nature* 584 (7821): 393–97. https://doi.org/10.1038/s41586-020-2591-3.

Accelerated Sea Level Rise on the East and Gulf Coasts

Recent analysis on sea level rise for U.S. coastal communities show that the East and Gulf Coasts are consistently hotspots for sea-level rise .[21,22,23] A 2025 study by the Woods Hole Oceanographic Institution found that the rate of relative sea-level rise - measured relative to the local land surface - along the U.S. coast has more than doubled in the past 125 years, increasing from approximately 1.7 millimeters per year in 1900 to over 4.3 millimeters per year in 2024.[24] This rate is well above the global average for sea-level rise **of ~3.1 mm/year** observed in recent decades[25].

The William & Mary Virginia Institute of Marine Science 2024 Sea Level Report Cards, which analyze data from 36 U.S. coastal communities, confirm this acceleration which can be compared to the global average. The report cards show that sea level rise acceleration rates began increasing notably around 2013-2014 along the East and Gulf Coasts.[26] Most sea level projections are based on an understanding of average global sea level rise, but these local report cards demonstrate that the reality for U.S. coastal communities diverges significantly from global averages due to regional factors. Along the East and Gulf Coasts, land subsidence, changes in ocean currents, and glacial isostatic adjustment creates hotspots where relative sea level rise can exceed global averages. For instance, Grand Isle, Louisiana, is currently experiencing a rise rate of 7.72 mm/year, while Rockport, Texas, and Norfolk, Virginia, face rates of 6.71 mm/year and 5.14 mm/year, respectively—far outpacing the global mean of approximately 3.1 mm/year. [27,28] Other regions may experience slower rates. Such spatial variability means communities face divergent risks that global projections do not capture.

Disproportionate Warming Rates

Many regions of the U.S. are experiencing disproportionate warming rates compared to the global average. For most years since the 1970s, the average surface temperature in the U.S. has risen faster than the global average temperature.[29,30] The 5th US National Climate Assessment states that the

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[21] Boon, John D., Molly Mitchell, Jon Derek Loftis, and David L. Malmquist. 2018. *Anthropocene Sea Level Change: A History of Recent Trends Observed in the U.S. East, Gulf, and West Coast Regions*. https://doi.org/10.21220/V5T17T.

[22] Sallenger, Asbury H., Kara S. Doran, and Peter A. Howd. 2012. "Hotspot of Accelerated Sea-Level Rise on the Atlantic Coast of North America." *Nature Climate Change* 2 (12): 884–88. https://doi.org/10.1038/nclimate1597.

[23] Sweet et al. 2022. *Global and Regional Sea Level Rise*

[24] Piecuch. *Rate of U.S. Coastal Sea-Level Rise*

[25] Sweet et al. 2022. *Global and Regional Sea Level Rise*

[26] Boon et al 2018. *Anthropocene Sea Level Change*

[27] Sweet et al. 2022. *Global and Regional Sea Level Rise*

[28] Boon et al 2018. *Anthropocene Sea Level Change*

[29] U.S. Environmental Protection Agency. (2024). Climate change indicators in the United States (Fifth ed., EPA 430-R-24-003). www.epa.gov/climate-indicators

[30] Jay, A.K., A.R. Crimmins, C.W. Avery, T.A. Dahl, R.S. Dodder, B.D. Hamlington, A. Lustig, K. Marvel, P.A. Méndez-Lazaro, M.S. Osler, A. Terando, E.S. Weeks, and A. Zycherman, 2023: Ch. 1. Overview: Understanding risks, impacts, and responses. In: *Fifth National Climate Assessment*. Crimmins, A.R., C.W.

continental U.S. has warmed 60% faster than the global average since 1970.[31] This is in part due to land areas warming faster than oceans, but also results from regional climate dynamics. This means that the historical and projected warming that Americans experience where they live is inherently higher than the 'global average' temperatures commonly reported (Fig. 2).

For example, Alaska is warming significantly faster than the global average (Fig.2). This phenomenon is called arctic amplification and is driven by the loss of reflective sea ice and snow that drives the Arctic region to warm significantly faster than the global average. When bright, reflective ice melts, it exposes darker ocean waters that absorb more heat from the sun, creating a feedback loop that accelerates warming. The smallest peak sea ice extent in the 47-year satellite record occurred in March 2025.[32]

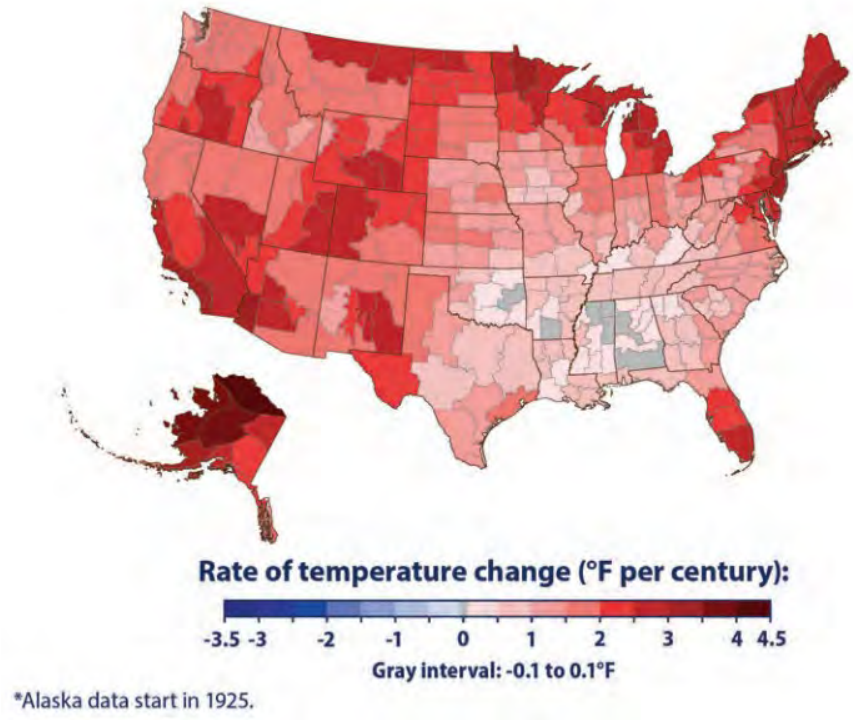

Figure 2 – Rate of Temperature change in the U.S. between 1901 and 2023 for the contiguous 48 states and between 1925 and 2023 for Alaska. The data are shown for climate divisions, as defined by NOAA.[33]

Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA.

[31] Marvel, Kate, Wenying Su, Roberto Delgado, et al. 2023. *Chapter 2 : Climate Trends. Fifth National Climate Assessment*. Edited by Allison R. Crimmins, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, Brooke C. Stewart, and Thomas K. Maycock. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023.CH2.

[32] NOAA in the Arctic. 2025. "Arctic Report Card: Update for 2025." https://arctic.noaa.gov/report-card/report-card-2025/.

[33] U.S. Environmental Protection Agency. *Climate change indicators in the United States.*

Findings from the 2025 Arctic Report Card, released by NOAA, confirm that the Arctic, globally, has warmed more than three times faster than the rest of the planet since 1980.[34] For the period of October 2024 through September 2025, the Arctic experienced its warmest temperatures on record since measurements began in 1900. The last ten years in the Arctic are the ten warmest on record, with annual temperatures increasing at more than double the global rate since 2006 (Fig. 3).[35]

The Alaska Climate Research Center reported 2025 as one of Alaska's warmest years in the past 100, with northern Alaska exhibiting warming consistent with this broader Arctic pattern.[36] Elevated temperatures throughout the year contributed to diminished spring snowpack, earlier snowmelt, and increased wildfire risk, with Interior Alaska experiencing the most pronounced effects.[37]

Fig. 1. Arctic Report Card Vital Signs with selected noteworthy trends and observations. The ARC annually reports on eight Vital Sign topics. Vital Sign data records vary in length based on dataset availability and considerations to methodological continuity. The historical record periods are used when computing ranked observations. When reporting anomalies, Vital Signs currently use 1991-2020 as the 30-year reference period, except for Tundra Greenness (2000-24) and Ocean Primary Productivity (2003-24).

Figure 3 - Summary of key Arctic "Vital Signs" showing major environmental changes. Indicators include temperature, precipitation, snow cover, sea ice, ocean productivity, tundra greenness, and the Greenland Ice Sheet. Overall, the Arctic is warming rapidly, with declining ice and snow and increasing precipitation and vegetation.[38]

[34] NOAA. *Arctic Report Card.*
[35] NOAA. *Arctic Report Card.*
[36] *2025 Alaska Annual Climate Report.* 2025. Alaska Climate Research Center: The Alaska State Climate Center. https://akclimate.org/data/annual-reports/.
[37] *2025 Alaska Annual Climate Report.*
[38] NOAA. *Arctic Report Card.*

Another example is in the U.S. Northeast, the fastest warming region in the contiguous U.S.[39] Many Northeast states including Maine,[40] New Jersey,[41] and Rhode Island,[42] have had a 3°F (~1.7°C) to 4°F (~2.2°C) increase in their average temperature since the early 20th Century, nearly twice the rate of global average warming. Studies attribute this amplified regional warming to a combination of anthropogenic-influenced factors: rapid ocean warming across the Northeast continental shelf and consequent regional atmospheric circulation changes,[43] decreasing snow cover that amplify land-warming,[44] and the disproportionate warming of nighttime and winter temperatures relative to daytime and summer temperatures in higher latitudes.[45]

III. Limitations of Averaging Over Temporal Scales

There are also limitations when averaging GMST and GMSL over temporal scales to assess U.S. risk. Mean temperatures alone cannot capture changes in extremes; extremes are impacted by changes to their mean and distribution. Therefore, averaging GMST over a specific time-period may not account for the distributional shifts of extreme events over that period. In fact, data show that GMST masks the increase in heat-related extremes, including multi-day heatwaves, which are consequential for heat- related adverse health outcomes.[46]

For example, in the United States, the annual number of heatwaves has doubled since the 1980s and the heatwave season has increased threefold in length since the 1960s.[47] A recent study of heat-related mortality among older adults in the United States drives home the disproportionate consequences of climate impacts, finding: "…heat waves are driving a substantial increase in deaths

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[39] Karmalkar, Ambarish V., and Raymond S. Bradley. 2017. "Consequences of Global Warming of 1.5 °C and 2 °C for Regional Temperature and Precipitation Changes in the Contiguous United States." *PLOS ONE* 12 (1): e0168697. https://doi.org/10.1371/journal.pone.0168697

[40] Maine Climate Council Scientific and Technical Subcommittee; Fernandez, Ivan; Marvinney, Robert; Arnold, Susie; Bacon, Linda; Barton, Andrew; Beal, Brian; Birkel, Sean; Black, Russell; Contosta, Alix; Cross, Amanda; Daigneault, Adam; Danielson, Thomas; Dickson, Stephen; DiFranco, Jeanne; Elias, Susan; Hodgkins, Glenn; Hubbell, Brian; Kelley, Joe; Kersbergen, Rick; Koehler, Glen; Lincoln, Rebecca; Livingston, William; Lombard, Pamela; Lyon, Bradfield; Pershing, Andrew; Price, Nichole; Rubin, Jonathan; Salisbury, Joseph; Simons-Legaard, Erin; Slovinsky, Peter; Steneck, Robert; Stockwell, Sally; Wahle, Richard; Wason, Jay; Weiskittel, Aaron; and Wilson, Carl, "Scientific Assessment of Climate Change and Its Effects in Maine" (2020). Climate Change. 1. https://digitalcommons.library.umaine.edu/maine_env_climate/1

[41] Davies, Kathryn, Anthony J. Broccoli, James B. Shope, et al. 2025. *State of the Climate: New Jersey 2024*. Rutgers University. Application/pdf. https://doi.org/10.7282/00000539.

[42] Runkle, J., K.E. Kunkel, D.R. Easterling, B.C. Stewart, S.M. Champion, L.E. Stevens, R. Frankson, W. Sweet, and J. Spaccio, 2022: Rhode Island State Climate Summary 2022. NOAA Technical Report NESDIS 150-RI. NOAA/NESDIS, Silver Spring, MD, 4 pp.

[43] Karmalkar, et al. *Drivers of Exceptional Coastal Warming.*

[44] Young and Young. *Decreasing Snow Cover.*

[45] Marvel, et al. *Climate Trends.*

[46] Davariashtiyani, Ali, Mohsen Taherkhani, Seyyedfaridoddin Fattahpour, and Sean Vitousek. 2023. "Exponential Increases in High-Temperature Extremes in North America." *Scientific Reports* 13 (1): 19177. https://doi.org/10.1038/s41598-023-41347-3.

[47] Bell, Michelle L., Antonio Gasparrini, and Georges C. Benjamin. 2024. "Climate Change, Extreme Heat, and Health." *New England Journal of Medicine* 390 (19): 1793–801. https://doi.org/10.1056/NEJMra2210769.

among older US adults each year, with disproportionate impacts on Black and low income communities, while neighborhoods with more green space see lower death rates."[48] According to the study, "Across the contiguous USA from 2000–18, the 8307 observed heat waves were associated with an estimated 17,603 excess deaths."[49]

For example, since 1993, global sea level has risen by 4 inches[50] (10 centimeters), and the rate of rise has doubled over the past 30 years (Fig. 4).[51,52] In 2024, global sea level rose at a rate of 0.23 inches (0.59 cm) per year, more than 30% more than the expected rate of 0.17 inches (0.43 cm).[53] According to a NASA-led analysis, this spike was driven largely by thermal expansion—the physical expansion of seawater as it warms. In a typical year, melting ice contributes the majority of sea-level rise, with thermal expansion accounting for about one-third. However, in 2024, as the warmest year on record, this ratio flipped: two-thirds of the rise came from thermal expansion.[54] **This phenomenon illustrates that the relationship between temperature and sea level is not static over space or time**. As the ocean absorbs excess heat, the water expands. Even a "small" average temperature increase in the upper ocean layers results in a measurable, accelerating rise in sea level.

Furthermore, temperature and sea-level exhibit time-dependent responses; temporal averaging of GMST and GMSL dampens their evolving relationships, feedbacks, and underlying dynamics.

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[48] Healy, James P., Edgar Castro, Mahdieh Danesh Yazdi, et al. 2026. "Heat Waves and Annual Mortality among Older Adults (Aged ≥65 Years) in the USA." *The Lancet Planetary Health* 10 (2): 101432. https://doi.org/10.1016/j.lanplh.2026.101432.

[49] Healy, et al. *Heat Waves and Annual Mortality.*

[50] Lee, Jane J. 2025. "NASA Analysis Shows Unexpected Amount of Sea Level Rise in 2024." NASA Sea Level Change, NASA's Jet Propulsion Laboratory, March 13. https://sealevel.nasa.gov/news/282/nasa-analysis-shows-unexpected-amount-of-sea-level-rise-in-2024/.

[51] Hamlington, Benjamin D., Severine Fournier, Philip R. Thompson, and Marta Marcos. 2025. "Sea Level Rise in 2024." *Nature Reviews Earth & Environment* 6 (4): 246–48. https://doi.org/10.1038/s43017-025-00667-w.

[52] Hamlington, B. D., A. Bellas-Manley, J. K. Willis, et al. 2024. "The Rate of Global Sea Level Rise Doubled during the Past Three Decades." *Communications Earth & Environment* 5 (1): 601. https://doi.org/10.1038/s43247-024-01761-5.

[53] Lee. *NASA Analysis.*

[54] Lee. *NASA Analysis.*

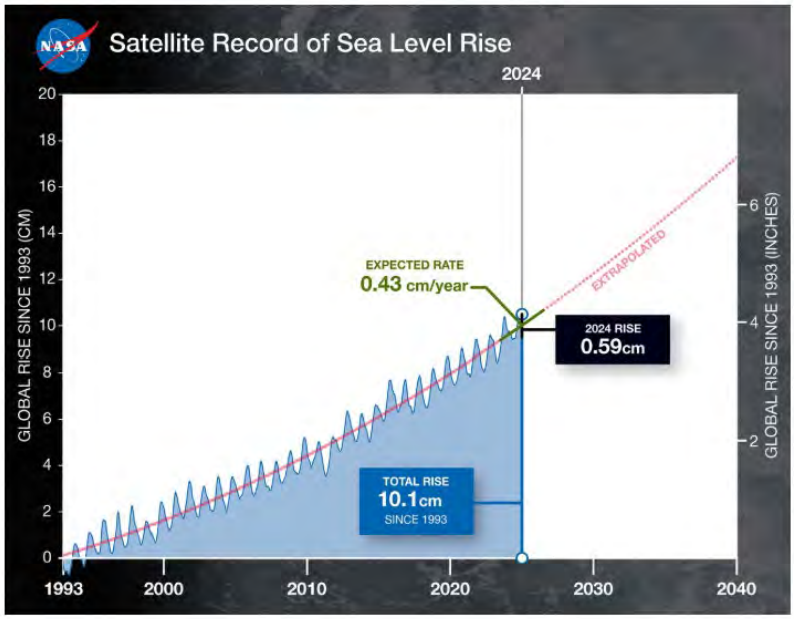

Figure 4 - Satellite-derived record of global mean sea level rise from 1993 to 2024 as measured by five satellites. The blue curve shows observed sea level change with seasonal variability, while the solid red line indicates the long-term trend, which has accelerated over time. The dotted red line indicates the trajectory of this increase. By 2024, global sea level has risen approximately 10.1 cm since 1993, with a recent annual increase of about 0.59 cm. The dotted red line represents extrapolated future rise, compared with an expected rate of 0.43 cm per year.[55]

IV. Limitations of Ignoring Non-Linearities

Limitations of Global Mean Metrics in Assessing Regional Climate Risk

In regulatory and policy discourse, descriptions of climate change that focus solely on increases in GMST and GMSL can misrepresent these changes as manageable despite strong evidence that small increments of change in global averages trigger disproportionate and potentially disruptive changes in regional climate dynamics, extreme weather frequency and/or intensity, and ecosystem stability. Many climate systems are non-linear, and the impacts of climate change are not distributed evenly across the globe.[56,57,58,59] Domestic regulatory policies must account for the discrepancy between global average impacts and the local reality for Americans. While the globe, on average, may warm by a specific margin, parts of the U.S. are experiencing temperature changes that are two to three

[55] Lee. *NASA Analysis.*
[56] Sadai, Shaina, Ambarish V. Karmalkar, David Pollard, et al. 2025. "Antarctic Meltwater Alters Future Projections of Climate and Sea Level." *Nature Communications* 16 (1): 9271. https://doi.org/10.1038/s41467-025-64438-3.
[57] Rivas, María Dolores Gadea, and Jesús Gonzalo. 2026. "Regional Heterogeneity and Warming Dominance in the United States." *PLOS Climate* 5 (2): e0000808. https://doi.org/10.1371/journal.pclm.0000808.
[58] Young and Young. *Decreasing Snow Cover.*
[59] Climate Central. 2025. "Earth Day: Fastest-Warming U.S. Cities and States." April 16. https://www.climatecentral.org/climate-matters/earth-day-fastest-warming-us-cities-and-states#cm-license.

times more severe.[60,61] Similarly, while global average sea levels rise at a seemingly moderate pace, specific American coastlines are facing accelerated flooding and inundation that threaten critical infrastructure, public health, and economic stability much sooner than global models suggest.[62,63,64,65]

The relationship between GMST and extreme weather frequency and/or intensity is governed by non-linear dynamics in the climate system. Incremental increases in atmospheric and oceanic heat content produce disproportionate changes in the distribution of weather events, such as elevated probabilities of extreme events relative to baseline conditions.[66] This phenomenon is well-documented in peer-reviewed literature, where small shifts in mean temperature correspond to non-linear increases in the frequency of threshold-exceeding events, including heat waves, heavy precipitation, drought conditions, and hydroclimate volatility.[67,68,69,70]

The impact of sea-level rise (SLR) on flooding is often exponential, not linear. As noted in peer-reviewed research, a small increase in the baseline sea level dramatically increases the frequency of high-tide flooding.[71,72] What was once a 1-in-100-year flood event can become a 1-in-10-year event with only a few inches of rise. Sea level acts as a rising floor, such that storm surges and high tides start from a higher baseline, allowing them to breach defenses that were previously sufficient.

Research published in *Scientific Reports* demonstrated that coastal flooding frequency is doubling every few years in many locations—including US Gulf Coast, East Coast, and Caribbean

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[60] Druckenmiller, et al. *Arctic Report Card.*
[61] Young and Young. *Decreasing Snow Cover.*
[62] Piecuch. *Rate of U.S. Coastal Sea-Level Rise.*
[63] Dangendorf, Sönke, Noah Hendricks, Qiang Sun, et al. 2023. "Acceleration of U.S. Southeast and Gulf Coast Sea-Level Rise Amplified by Internal Climate Variability." *Nature Communications* 14 (1): 1935. https://doi.org/10.1038/s41467-023-37649-9.
[64] Gilmore, Elisabeth A., Carolyn Kousky, and Travis St.Clair. 2022. "Climate Change Will Increase Local Government Fiscal Stress in the United States." *Nature Climate Change* 12 (3): 216–18. https://doi.org/10.1038/s41558-022-01311-x.
[65] Hino, Miyuki, Samanthe Tiver Belanger, Christopher B. Field, Alexander R. Davies, and Katharine J. Mach. 2019. "High-Tide Flooding Disrupts Local Economic Activity." Science Advances 5 (2): eaau2736. https://doi.org/10.1126/sciadv.aau2736.
[66] IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. Chapter 12.
[67] Diffenbaugh, Noah S., and Filippo Giorgi. 2012. "Climate Change Hotspots in the CMIP5 Global Climate Model Ensemble." *Climatic Change* 114 (3–4): 813–22. https://doi.org/10.1007/s10584-012-0570-x.
[68] IPCC. *Impacts, Adaptation and Vulnerability.*
[69] Swain, Daniel L., Andreas F. Prein, John T. Abatzoglou, et al. 2025. "Hydroclimate Volatility on a Warming Earth." *Nature Reviews Earth & Environment* 6 (1): 35–50. https://doi.org/10.1038/s43017-024-00624-z.
[70] Mearns, Linda O., Richard W. Katz, and Stephen H. Schneider. 1984. "Extreme High-Temperature Events: Changes in Their Probabilities with Changes in Mean Temperature." *Journal of Climate and Applied Meteorology* 23 (12): 1601–13. https://doi.org/10.1175/1520-0450(1984)023%253C1601:EHTECI%253E2.0.CO;2.
[71] Vitousek, Sean, Patrick L. Barnard, Charles H. Fletcher, Neil Frazer, Li Erikson, and Curt D. Storlazzi. 2017. "Doubling of Coastal Flooding Frequency within Decades Due to Sea-Level Rise." *Scientific Reports* 7 (1): 1399. https://doi.org/10.1038/s41598-017-01362-7.
[72] Sweet et al. 2022. *Global and Regional Sea Level Rise.*

territories— due to sea-level rise, even without increases in storm intensity.[73,74] This research highlights how even 10 cm of SLR doubles flooding potential along the west coast of the US, including Seattle, San Francisco and Los Angeles,[75] highlighting that the "magnitude" of the rise is less relevant than the "frequency" of the resulting impact. A rise of a few inches can double or triple the number of days a coastal community is inundated, leading to chronic infrastructure degradation, mold growth in homes, and disruption of local economies. Related research highlights how even smaller amounts of sea level rise, between 1 and 10 cm, can lead to outsized impacts by increasing the frequency of coastal floods.[76] This underscores why looking at GLSR alone is not sufficient to understand how that change will impact Americans.

Regional Variation in Extreme Weather Event Trends

A focus on only GMST and GSLR fails to account for how changes in those metrics will lead to more frequent and intense extreme weather, the primary way that climate change harms human health and welfare. Americans do not experience "global averages"; they experience hurricanes, droughts, rainfall, heatwaves, wildfires, and floods. Climate change is contributing to the increase in frequency, duration, and/or intensity of these types of events, regardless of the magnitude of the shift in global averages. For example, data show that heatwaves are increasing in frequency and duration, especially in the western U.S. and Southeast.[77]

Similarly, warmer ocean temperatures provide more energy for hurricanes, leading to stronger, wetter, and slower-moving hurricanes.[78,79] In 2024, the U.S. experienced 27 separate weather and climate disasters with costs exceeding $1 billion each (Fig. 5).[80] Over the last decade (2015–2024), the U.S. has been impacted by 190 such disasters, costing approximately $1.4 trillion and killing more than 6,300 people (Fig. 5).[81]

These extreme events are not random; they are symptomatic of a changing climate, which is not fully captured by expressions of global mean temperatures.

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[73] Sweet et al. 2022. *Global and Regional Sea Level Rise.*
[74] Vitousek et al. *Doubling of Coastal Flooding.*
[75] Vitousek et al. *Doubling of Coastal Flooding.*
[76] Taherkhani, M., Vitousek, S., Barnard, P.L., Frazer, N., Anderson, T.A., and Charles H. Fletcher. 2020. "Sea-level rise exponentially increases coastal flood frequency." *Scientific Reports* 10, 6466. https://doi.org/10.1038/s41598-020-62188-4
[77] Committee on Anthropogenic Greenhouse Gases and U.S. Climate: Evidence and Impacts, Climate Crossroads, Board on Atmospheric Sciences and Climate, et al. 2025. *Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare.* National Academies Press. https://doi.org/10.17226/29239.
[78] Kossin, James P. 2018. "A Global Slowdown of Tropical-Cyclone Translation Speed." *Nature* 558 (7708): 104–7. https://doi.org/10.1038/s41586-018-0158-3.
[79] Gilford, Daniel M., Joseph Giguere, and Andrew J. Pershing. 2024. "Human-Caused Ocean Warming Has Intensified Recent Hurricanes." *Environmental Research: Climate* 3 (4): 045019. https://doi.org/10.1088/2752-5295/ad8d02.
[80] Smith. *Billion-Dollar Disasters.*
[81] Smith. *Billion-Dollar Disasters.*

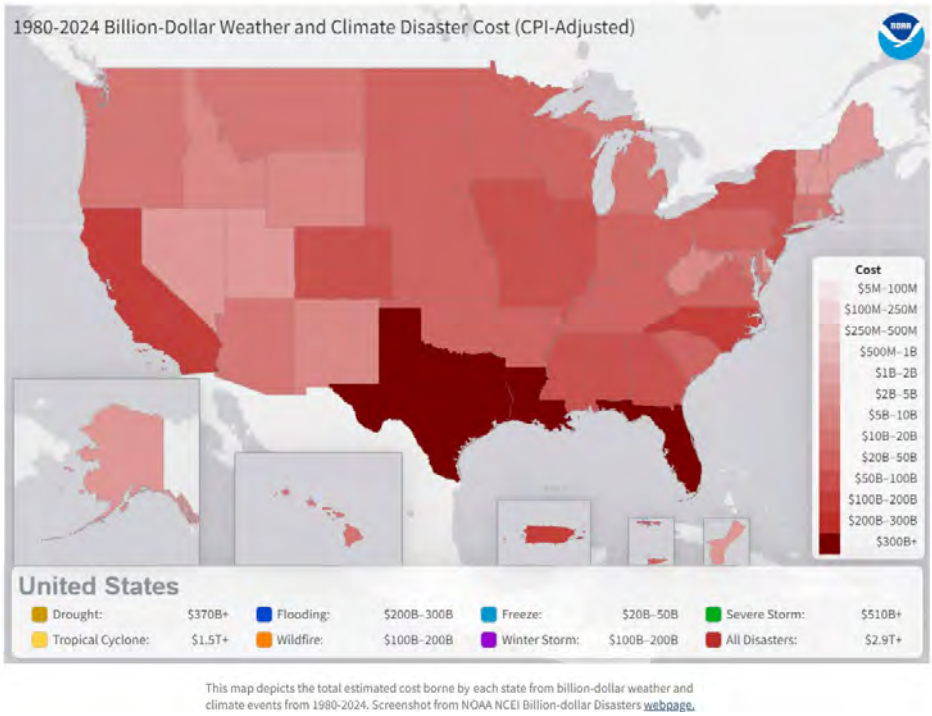

Figure 5- Map of total costs from billion-dollar weather and climate disasters across the United States from 1980 to 2024 (CPI-adjusted). Darker shading indicates higher total damages, with the greatest costs concentrated in Gulf Coast and southeastern states.[82]

V. Global Average Temperatures are the Wrong Metric for Health Impacts[83,84]

Similarly, a focus on GMST and GSLR fails to account for the inequitably distributed health harms that stem from climate change, including extreme heat, increases in exposure to wildfire smoke, and changes to vector-borne and water-borne diseases. GMST and GSLR are spatially and temporally aggregated metrics that smooth over the regional and seasonal extremes and local variabilities where health impacts materialize. They reveal nothing about extreme events, differential exposure, vulnerability, or adaptive capacity – the factors that determine whether a temperature increase becomes a health crisis. An annual global average does not distinguish between an early season extreme heatwave or a community with air conditioning and green space versus one without; similarly, global sea level rise tells us little about which populations live near flood-prone hazardous sites. These metrics were designed to track planetary physics at an aggregated level, not human welfare, much less the welfare of Americans specifically.

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[82] Smith. *Billion-Dollar Disasters.*
[83] CDC. 2024. "About CDC's Climate and Health Program." February 9. https://www.cdc.gov/climate-health/php/about/index.html.
[84] Committee on Anthropogenic Greenhouse Gases and U.S. Climate: Evidence and Impacts, Climate Crossroads, Board on Atmospheric Sciences and Climate, et al. 2025. "Chapter 5 Impacts on Human Health." In *Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare*. National Academies Press. https://doi.org/10.17226/29239.

GMST is the wrong indicator for health impacts because averages mask the reality of extreme heat and heatwaves or socioeconomic determinants of health, which are known to be major drivers of heat related deaths and illnesses globally and in the U.S. Climate change is already increasing the frequency, duration and intensity of heatwaves, including increases in night-time heat.[85]

Failing to consider how increases in GMST manifest on the ground in the U.S. within the U.S. obscures the extent of the human health and welfare implications. Extreme heat days are also associated with a significant increase in emergency room visits.[86] Research also shows that climate-driven extreme heat could lead to a loss of about 1.2% in U.S. GDP per degree Celsius increase in temperature, including labor costs, mortality costs and costs to major economic sectors.[87] Outdoor workers could experience an estimated $49.2 billion in annual earnings at risk by the end of the century.[88] Without action to curtail heat-trapping emissions, the incidence of extreme heat—and its impacts on people—will increase significantly in the U.S.[89] A focus solely on GMST fails to capture human health harms for Americans.

Extreme heat is the leading weather-related killer in the United States.[90] Driven by climate change, extreme heat and drought are becoming hotter, longer lasting, and more frequent.[91] The summer of 2024 was the hottest year on record for the world, however the global mean temperature reflected in that record does not capture the cascade of impacts that directly result from warmer temperatures globally and in the U.S. The long-term trend in the increase in frequency and intensity of heatwaves is a major challenge to human health, through heat exhaustion and heat stroke, and by exacerbating cardiovascular, respiratory, and kidney conditions.[92,93,94] Outdoor workers, elderly people, young

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[85] Marvel, et al. *Climate Trends.*
[86] Sun, Shengzhi, Kate R. Weinberger, Amruta Nori-Sarma, et al. 2021. "Ambient Heat and Risks of Emergency Department Visits among Adults in the United States: Time Stratified Case Crossover Study." *BMJ* 375 (November): e065653. https://doi.org/10.1136/bmj-2021-065653.
[87] Hsiang, Solomon, Robert Kopp, Amir Jina, et al. 2017. "Estimating Economic Damage from Climate Change in the United States." *Science* 356 (6345): 1362–69. https://doi.org/10.1126/science.aal4369.
[88] Licker, Rachel, Kristina Dahl, and John T. Abatzoglou. 2022. "Quantifying the Impact of Future Extreme Heat on the Outdoor Work Sector in the United States." *Elementa: Science of the Anthropocene* 10 (1): 00048. https://doi.org/10.1525/elementa.2021.00048.
[89] Dahl, Kristina, Rachel Licker, John T. Abatzoglou, and Juan Declet-Barreto. 2019. "Increased Frequency of and Population Exposure to Extreme Heat Index Days in the United States during the 21st Century." *Environmental Research Communications* 1 (7): 075002. https://doi.org/10.1088/2515-7620/ab27cf.
[90] NOAA National Weather Service. n.d. "National Weather Service." Severe Weather Awareness - Heat Waves. https://www.weather.gov/mkx/heatwaves.
[91] Shindell, Drew, Yuqiang Zhang, Melissa Scott, Muye Ru, Krista Stark, and Kristie L. Ebi. 2020. "The Effects of Heat Exposure on Human Mortality Throughout the United States." *GeoHealth* 4 (4): e2019GH000234. https://doi.org/10.1029/2019GH000234.
[92] Marino, et al. *Commonwealth Fund.*
[93] National Academies of Sciences, Engineering, and Medicine. 2025. *Effects of Human-Caused Greenhouse Gas Emissions on U.S. Climate, Health, and Welfare*. Washington, DC: The National Academies Press.
[94] Hayden, Mary H., Paul J. Schramm, Charles B. Beard, et al. 2023. *Chapter 15 : Human Health. Fifth National Climate Assessment*. Edited by Allison R. Crimmins, Christopher W. Avery, David R. Easterling, Kenneth E. Kunkel, Brooke C. Stewart, and Thomas K. Maycock. U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023.CH15.

children, pregnant people, people who are unhoused, and people with pre-existing health conditions are most at risk.[95,96] The impacts of climate change compound and build on each other. Heatwaves, for example, exacerbate cardiovascular and respiratory conditions,[97,98] while compromised food and water security[99] due to extreme heat and drought increases risks of malnutrition and infectious diseases.[100] Drought also contributes to respiratory and cardiovascular-related health impacts - dry conditions increase airborne dust and particulate matter while simultaneously elevating wildfire risk, exposing populations to fine particles that penetrate deep into lungs and trigger systemic inflammation.[101,102]

A 2025 Commonwealth Fund report on climate and health highlighted that environmental hazards, many of which are exacerbated by climate change, are responsible for approximately 19% of deaths globally.[103] According to the 2025 Lancet Countdown report on Health and Climate Change, "*on average, 16 (84%) of the 19 life-threatening heatwave days that people were exposed to annually in 2020–24 would not have occurred without climate change.*"[104] In the U.S., the health care sector itself is vulnerable: nearly 15% of hospital beds in Florida are in high-hazard flood zones, and facilities across the country are ill-prepared for the increasing frequency of extreme weather.[105] The report found that states with higher environmental risks and weaker clean energy policies face greater health burdens.

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[95] Romanello, Marina, Maria Walawender, Shih-Che Hsu, et al. 2024. "The 2024 Report of the Lancet Countdown on Health and Climate Change: Facing Record-Breaking Threats from Delayed Action." *The Lancet* 404 (10465): 1847–96. https://doi.org/10.1016/S0140-6736(24)01822-1.

[96] Chersich, Matthew Francis, Minh Duc Pham, Ashtyn Areal, et al. 2020. "Associations between High Temperatures in Pregnancy and Risk of Preterm Birth, Low Birth Weight, and Stillbirths: Systematic Review and Meta-Analysis."
BMJ, November 4, m3811. https://doi.org/10.1136/bmj.m3811.

[97] Silveira, Ismael H., Taísa Rodrigues Cortes, Michelle L. Bell, and Washington Leite Junger. 2023. "Effects of Heat Waves on Cardiovascular and Respiratory Mortality in Rio de Janeiro, Brazil." *PLOS ONE* 18 (3): e0283899. https://doi.org/10.1371/journal.pone.0283899.

[98] Psistaki, Kyriaki, Panayiotis Kouis, Panayiotis K. Yiallouros, and Anastasia K. Paschalidou. 2025. "Heatwave Characteristics and Health Impacts: A Review of Epidemiological Evidence and Implications for Heatwave Response Plans." *Environmental Research: Health* 3 (4): 042003. https://doi.org/10.1088/2752-5309/ae1861.

[99] Lawrence, Sarah. 2021. "Infectious Disease and Climate Change: Food & Water Scarcity." Infectious Disease and Climate Change: Food & Water Scarcity, American Security Project, November 22. https://www.americansecurityproject.org/infectious-disease-and-climate-change-food-water-scarcity/.

[100] Romanello, et al. *2024 Report of the Lancet Countdown.*

[101] Gwon, Yeongjin, Yuanyuan Ji, Jesse E. Bell, et al. 2023. "The Association between Drought Exposure and Respiratory-Related Mortality in the United States from 2000 to 2018." *International Journal of Environmental Research and Public Health* 20 (12): 6076. https://doi.org/10.3390/ijerph20126076.

[102] Gwon, Yeongjin, Yuanyuan Ji, Azar M. Abadi, et al. 2024. "The Effect of Heterogeneous Severe Drought on All-Cause and Cardiovascular Mortality in the Northern Rockies and Plains of the United States." *Science of The Total Environment* 912 (February): 169033. https://doi.org/10.1016/j.scitotenv.2023.169033.

[103] Marino, et al. *Commonwealth Fund.*

[104] Romanello, Marina, Maria Walawender, Shih-Che Hsu, et al. 2025. "The 2025 Report of the Lancet Countdown on Health and Climate Change: Climate Change Action Offers a Lifeline." *The Lancet* 406 (10521): 2804–57. https://doi.org/10.1016/S0140-6736(25)01919-1.

[105] Marino, et al. *Commonwealth Fund.*

The impacts of climate change are not borne equally. Scientific evidence overwhelmingly shows that marginalized communities—low-income populations, communities of color, and Indigenous groups—face disproportionate risks[106] from both sea-level rise[107] and extreme weather, a reality not captured by a focus on global average temperature and global mean sea level rise.

A *Nature Communications* study on sea-level rise and hazardous sites revealed a stark environmental justice crisis. Controlling for population density, neighborhoods with higher proportions of renters, non-voters, linguistically isolated households, and residents living in poverty are significantly more likely to be located near hazardous sites at risk of flooding They found that a one standard deviation increase in the proportion of renters is associated with an up to 41% higher likelihood of having a hazardous site within 1 kilometer.[108]

This inequity is the result of historical land-use decisions and systemic discrimination. When sea levels rise or floods occur, these communities are the first to suffer contaminant releases, displacement, and health impacts. The cumulative impact of all of these factors exacerbates the disproportionate adverse health and welfare impacts for these communities, which EPA has completely failed to account for.

The Commonwealth Fund scorecard further illustrates this inequity. States with higher environmental risks often have weaker health care infrastructure and fewer resources for adaptation.[109] For example, low-lying coastal states like Florida and Louisiana have a high percentage of health care facilities in flood zones.

A focus on GMST and GSLR fails to capture both the human health impacts of climate change and the unequal effects of these impacts across populations and communities. As such, this focus is insufficient for preparing for the risks associated with current and further climate change in the U.S.

VI. Summary

The characterization of climate change impacts based solely on global mean surface temperature and global mean sea level oversimplifies the complex challenges that arise from physical, societal, economic, and ecological impacts associated with these increases. While the global averages may appear "small" in isolation, they mask a reality of profound regional disparity and escalating risk. The U.S. East and Gulf Coasts are facing accelerated sea-level rise that inundates communities and threatens to flood hazardous sites within decades, not centuries. Alaska is warming at a rate that is destabilizing the very ground its communities stand on. Such regional differences highlight how

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[106] United States Environmental Protection Agency. 2021. "EPA Report Shows Disproportionate Impacts of Climate Change on Socially Vulnerable Populations in the United States." News Release. September 2. https://www.epa.gov/newsreleases/epa-report-shows-disproportionate-impacts-climate-change-socially-vulnerable.

[107] Cushing, Lara J., Yang Ju, Seigi Karasaki, et al. 2025. "Sea Level Rise and Flooding of Hazardous Sites in Marginalized Communities across the United States." *Nature Communications* 16 (1): 9711. https://doi.org/10.1038/s41467-025-65168-2.

[108] Cushing, et al. *Sea Level Rise.*

[109] Marino, et al. *Commonwealth Fund.*

GMST and GSLR alone are inadequate measures of the full impact of climate change on communities, ecosystems and economies across the United States. And across the nation, extreme weather events, supercharged by climate warming, are inflicting billions of dollars in damage and causing significant threats to public health, including loss of life.

Here we show how frameworks that rely on global averages to assess risk at regional and local levels can systematically underestimate the threat to American health and welfare. For many Americans, the climate crisis is not a distant future scenario defined by global averages, but a present-day emergency defined by rising waters, intensifying storms, and disproportionate harm to the most vulnerable.

APPENDIX C

Technical Memorandum on EPA's Final Rule Analysis of Variability and Measurability

Ellen Robo and Grace Hauser, Environmental Defense Fund

This technical memorandum supports the petition filed by Environmental Defense Fund, Natural Resources Defense Council, et al. seeking reconsideration of EPA's final rule "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards," 91 Fed. Reg. 7,686 (Feb. 18, 2026). This memorandum provides technical analysis demonstrating that EPA's methods for assessing temperature variability and measurability in the Final Rule were flawed and systematically biased toward overstating temperature variability and temperature and sea level measurement uncertainty.[1] Section 1 addresses temperature variability, identifying five independent errors in EPA's approach — including failure to correct for the underlying upward trend in global mean surface temperature (GMST), reliance on annual rather than multi-year averages, a potentially inaccurate use of sample rather than population standard deviation, use of an unjustified and historically anomalous reference window (2016–2025), and inadequate consideration of interval length effects— each of which inflates EPA's variability estimate. Taken together, these errors cause EPA to overstate temperature variability by as much as 85%. Section 2 addresses measurability, showing that EPA's cited source does not support its stated uncertainty value, and that multiple independent datasets report measurement uncertainties materially lower than the levels EPA deemed de minimis.

I. Temperature variability

As discussed in the body of the petition, EPA's use of "temperature variability" as a metric to determine futility is inherently arbitrary. Here we demonstrate that—even accepting EPA's fatally flawed methodology of comparing projected global mean surface temperature impacts from section 202(a) regulation to a global mean surface temperature variability metric—EPA's stated GMST variability metric is itself arbitrary and appears to be the result of an arbitrary and unjustifiable methodology. EPA's process for determining the temperature variability in the climate system was flawed for at least five reasons which materially change the final result: (1) EPA failed to correct for the underlying increasing trend in global mean surface temperature; (2) annual averages are an inappropriately short timeframe to assess whether an increase in temperature would be

[1] This memorandum accepts as the starting point EPA's basic methodology of comparing certain variability and measurability metrics to projected impacts of US vehicle GHGs in order to determine the futility of section 202(a) GHG regulation. However, as explained in the petition, the underlying methodology is fundamentally arbitrary, capricious, and contrary to law. The more discrete critiques articulated in this memorandum, including the technical methodologies and numerical figures we present, do not imply that we in any way agree with EPA's basic methodology for assessing futility.

inconsequential given the "variability" in the system; (3) EPA should have used population standard deviation and not sample standard deviation if the Agency meant to describe "variability" for 2016-2025; (4) the use of the selected time period, 2016-2025, was arbitrary and particularly unsupportable if intended to represent "variability" in 1950-2025; and (5) the use of a 10-year time interval to calculate variability was arbitrary. Each of these arbitrary and/or irrational choices operates in the direction of overstating variability and therefore overstating the degree to which the policy signal is obscured by background noise. Section 1 identifies and addresses these flaws and undermines EPA's central claim that US motor vehicle GHG regulation is futile because its temperature impact is insignificant.

A. EPA failed to correct for the underlying upward trend in global mean surface temperature (GMST).

Global mean surface temperature has risen dramatically over the past century due to increasing concentrations of GHGs, such as carbon dioxide (CO_2), in the atmosphere (Figure 2). The global mean surface temperature anomalies time series[2] referred to by EPA has a clear and well-documented upward trend (Figure 1). It is unclear precisely how EPA computed a variability statistic of 0.14°C used to support the Rescission of the Endangerment Finding[3] because the Agency's statistical methods are not documented, an arbitrary error. We were able to reconstruct EPA's result of 0.14°C by calculating the sample standard deviation of annual global mean surface temperature anomaly values for 2016-2025 from the dataset cited by EPA. In the remainder of this memorandum, we assume that EPA followed this methodology and critique it accordingly.

[2] NOAA National Centers for Environmental Information (NCEI). (2026, April). *Climate at a Glance: Global Time Series*. Published March 2026, retrieved on April 3, 2026. https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/time-series

[3] Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards, 91 Fed. Reg. 7,686 (Feb. 18, 2026) ("Final Rule"). https://www.regulations.gov/document/EPA-HQ-OAR-2025-0194-31029

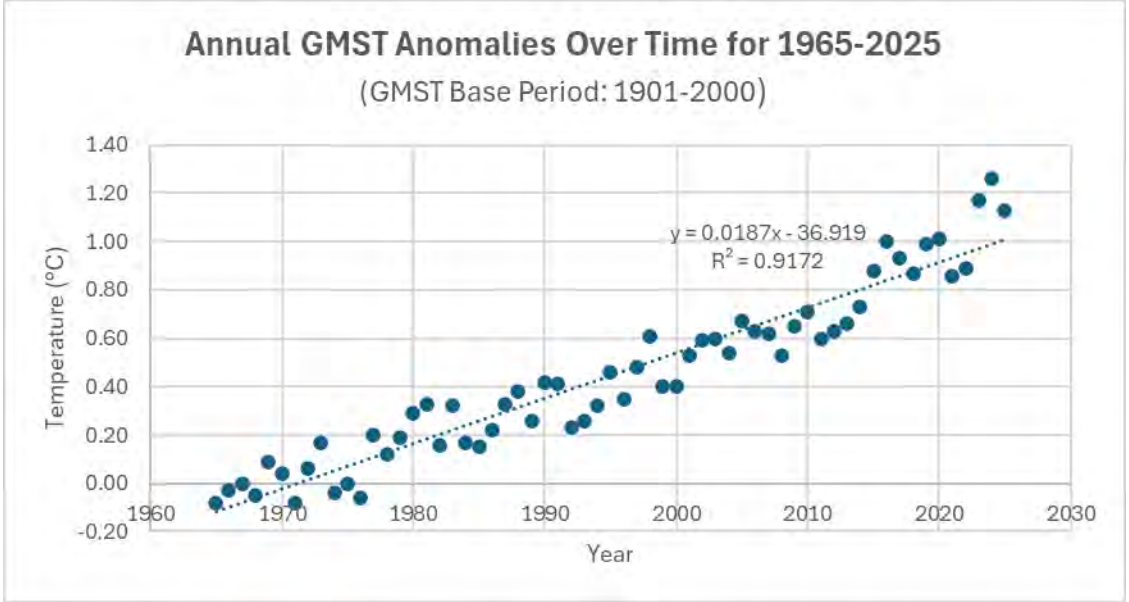

Figure 1. *Global mean surface temperature (GMST) anomalies (°C) with respect to the 1901-2000 average vs. time for 1965-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. Each dot represents the temperature anomaly for a given year. The dotted line is the line of best fit, which shows that GMST anomalies have increased during this period by a rate of roughly 0.019°C/year.*

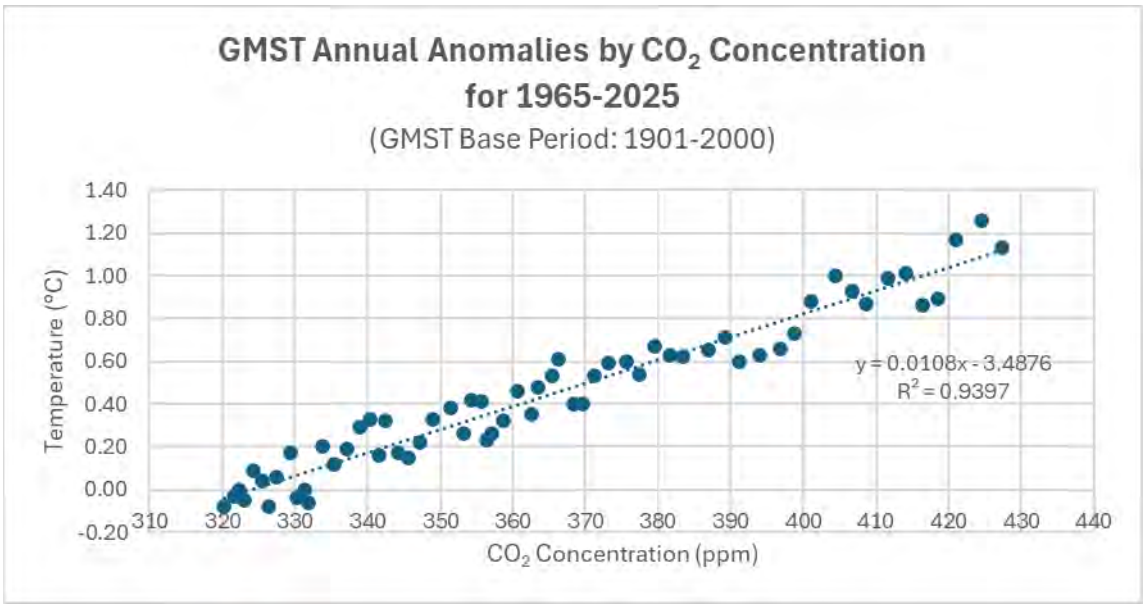

Figure 2. *Global mean surface temperature (GMST) anomalies (°C) with respect to the 1901-2000 average vs. Carbon dioxide (CO_2) concentration (ppm) for 1965-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. CO_2 data was sourced from NASA[4] for the years 1965-2011 (the most recent year*

[4] NASA Goddard Institute for Space Studies. (2012, February 6). *Global Mean CO_2 Mixing Ratios (ppm): Observations.* https://data.giss.nasa.gov/modelforce/ghgases/Fig1A.ext.txt

available) and from the NOAA Global Monitoring Lab[5] for the years 2012-2025. Each dot represents the temperature anomaly and CO_2 concentration for a given year. The dotted line is the line of best fit, which shows that GMST anomalies have increased during this period by a rate of roughly 0.011°C/ppm CO_2.

Global mean surface temperature changes across multiple time scales — from day-to-day and seasonal fluctuations to longer-term changes driven by anthropogenic GHG emissions.[6] Standard deviation measures dispersion around a constant mean and is best suited for a symmetric, bell-curved distribution.[7] When a long-term trend is present in the data, as with the well-documented upward trajectory of temperature, the data are not symmetrically distributed, and standard deviation is not appropriate to apply directly.[8] Statistical best practice requires first fitting and subtracting the trend, for instance using a least squares regression — retaining only the residuals — before calculating standard deviation.[9] EPA's cited 0.14°C standard deviation over 2016–2025[10] does not appear to account for this step, meaning the estimate likely conflates the underlying warming trend with genuine temperature variability, overstating the relative magnitude of variability. This failure to follow well-established statistical practices is clearly erroneous.

To illustrate why using standard deviation as a statistical method to evaluate variability without first correcting for the underlying trend is incorrect, we created a sample data set of annual means plotted in Figure 3. The purple line represents data with a steady and unequivocal upward trend over time, such as global mean surface temperature, while the orange line displays noisy data that is varying around a constant mean of 4.5, such as the trend exhibited by internal climate variability. The purple

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[5] NOAA Global Monitoring Laboratory. (2021, February 10). *Mauna Loa CO_2 annual mean data (CSV)*. Carbon Cycle Greenhouse Gases: Trends in CO_2, CH_4, N_2O, SF_6. https://gml.noaa.gov/ccgg/trends/data.html

[6] Hawkins, E. & Sutton, R. (2009). The potential to narrow uncertainty in regional climate predictions. *Bulletin of the American Meteorological Society, 90*(8), 1095-1108. https://doi.org/10.1175/2009BAMS2607.1

[7] El Omda, S., & Sergent, S. R. (2024). *Standard Deviation*. PubMed; StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK574574/. "The main issue is in data sets where there are extreme values or severe skewness, as these results can influence the mean and SD by a significant amount. Consequently, in scenarios where the data set does not follow a normal (Gaussian) distribution, other measures of dispersion are often used. Most commonly, the interquartile range (IQR) is used alongside the median of the dataset."

[8] Harrell, F. (2024, March 23). *What Does a Statistical Method Assume? – Statistical Thinking*. Statistical Thinking; Department of Biostatistics, Vanderbilt University School of Medicine. https://www.fharrell.com/post/assume/. "The standard deviation assumes that Y has a symmetric distribution whose dispersion is well described by a root mean squared measure"; "When the Y distribution is not symmetric, the SD may not be representative of the overall dispersion of Y."

[9] Brockwell, P. J., & Davis, R. A. (2016). Introduction. In *Introduction to time series and forecasting*. Springer. "If the seasonal and noise fluctuations appear to increase with the level of the process, then a preliminary transformation of the data is often used to make the transformed data more compatible with the model."

[10] 91 Fed. Reg. 7691 (Feb. 18, 2026): "For context, variability in GMST measurement from 2016 to 2025 was 0.14 °C, which is almost four times greater than the modeled GMST impact by 2100 of eliminating all U.S. vehicle and engine GHG emissions."

and orange lines have the same exact population standard deviation, 2.87, but the "interannual" variability is clearly greater for the orange line than the purple line.

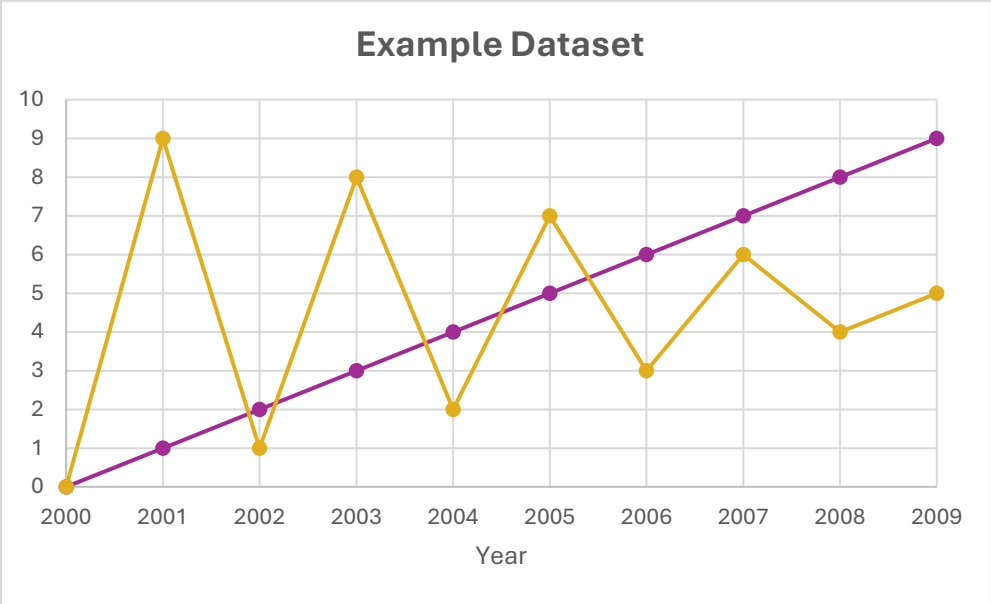

Figure 1. *Example dataset illustrating how standard deviation is not an appropriate way to measure variability. The purple line shows a steady and unequivocal upward trend while the orange line shows noisy data that is varying around a constant mean of 4.5. Though both datasets have a standard deviation of 2.87, the interannual variability of the datasets is different.*

Here we account for the underlying upward trend in global mean surface temperature over time. We use the same NCEI Climate at a Glance Global Time Series dataset[11] from which EPA sourced 1950-2025 global land and ocean average temperature anomalies data. We then plotted the 2016-2025 GMST anomalies data and calculated the line of best fit using linear least squares (Figure 4). We then calculated the residuals, or the difference between the observed data points and the line of best fit. Next, we calculated the sample standard deviation of the residuals. The result was a value of 0.1073°C, which is roughly 23% lower than EPA's calculated value of 0.14°C. Thus, EPA's choice to not correct for the trend before calculating the standard deviation was arbitrary and materially changed the outcome of the analysis.

[11] NOAA NCEI. *Climate at a Glance: Global Time Series*

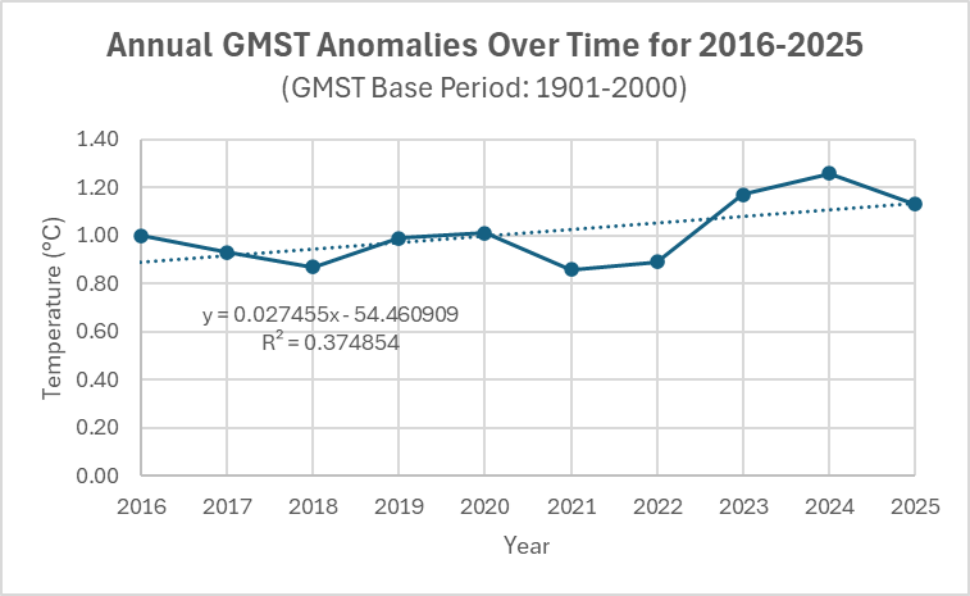

Figure 2. *Global mean surface temperature (GMST) anomalies (°C) with respect to the 1901-2000 average vs. time for 2016-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. Each dot represents the temperature anomaly for a given year. The dotted line is the line of best fit, which shows that GMST anomalies have increased during this period by a rate of roughly 0.028°C/year.*

The underlying cause of the temperature trend is not time itself — time is just a proxy. The actual physical driver of the trend is increasing concentrations of atmospheric CO_2 and other GHGs. To be more precise, here we repeat the process above but treat CO_2 as the independent variable and global mean surface temperature anomalies as the dependent variable (Figure 5). We calculated the sample standard deviation of the residuals to be 0.1049°C, and 25% lower than EPA's calculated value of 0.14°C.

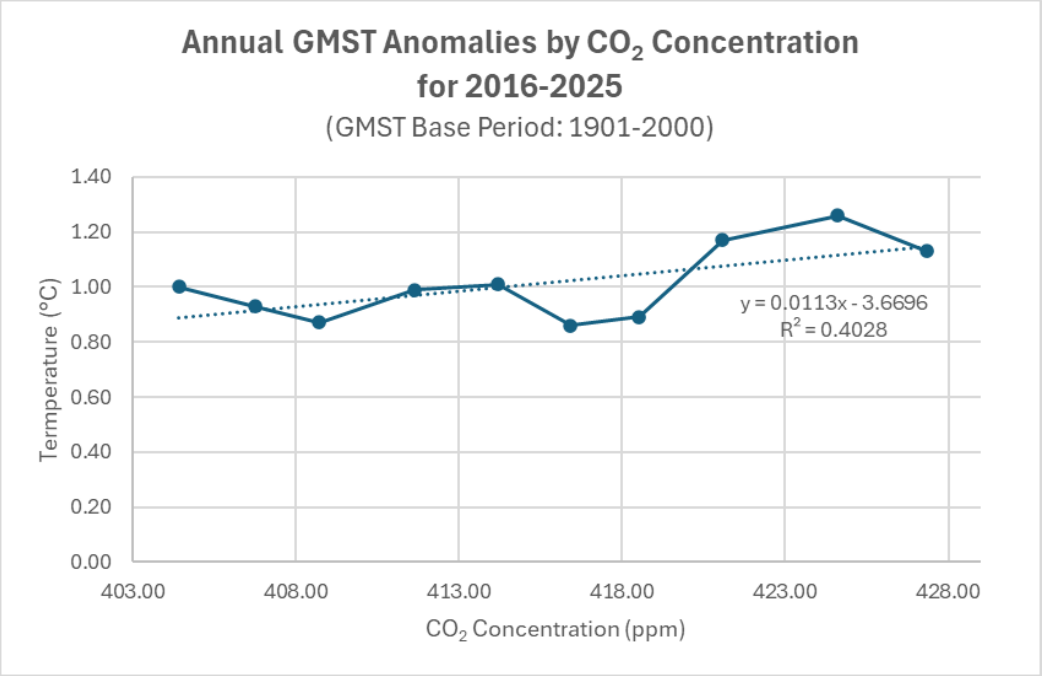

Figure 3. *Global mean surface temperature (GMST) anomalies (°C) with respect to the 1901-2000 average vs. carbon dioxide (CO_2) concentration (ppm) for 2016-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. CO_2 data was sourced from NASA for the years 1965-2011 (the most recent year available) and from the NOAA Global Monitoring Lab for the years 2012-2025. Each dot represents the temperature anomaly and CO_2 concentration for a given year. The dotted line is the line of best fit, which shows that GMST anomalies have increased during this period by a rate of roughly 0.011°C/ppm CO_2.*

Finally, even this approach is likely to overestimate true variability because it considers only CO_2 as the only explanatory variable. Global mean surface temperature is driven by a combination of radiative forcings, including other well-mixed GHGs (such as methane and nitrous oxide), aerosols, and natural forcings such as volcanic and solar variability. Climate science literature consistently shows that incorporating the full set of radiative forcings further reduces unexplained variability in temperature time series, as a larger share of the observed temperature change is attributed to known physical drivers rather than treated as residual noise.[12] Thus, a more complete physically based model would be expected to yield an even lower standard deviation of residuals than the CO_2 analysis presented here, reinforcing that EPA's estimate substantially overstates true temperature variability.

[12] Eyring, V., N.P. Gillett, K.M. Achuta Rao, R. Barimalala, M. Barreiro Parrillo, N. Bellouin, C. Cassou, P.J. Durack, Y. Kosaka, S. McGregor, S. Min, O. Morgenstern, and Y. Sun, 2021: Human Influence on the Climate System. 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, Cambridge, United Kingdom and New York, NY, USA, pp. 423–552, doi: 10.1017/9781009157896.005.

B. Annual averages are an inappropriately short timeframe to assess whether an increase in temperature would be inconsequential given the "variability" in the system

EPA's use of annual averages to consider sustained changes in temperature is inappropriate for a fundamental reason: annual temperature values contain a large amount of short-term noise driven by internal climate dynamics such as ENSO, which can shift global mean surface temperatures by several tenths of a degree from one year to the next. This short-term noise is not representative of the background climate change against which multi-decadal policy signals should be assessed. NOAA's NCEI explicitly recognizes this, noting that conventional climate normals are calculated as 30-year averages and serve as the standard benchmark for climate conditions. As NCEI states, these 30-year averages are used by meteorological organizations around the world precisely because they smooth out short-term fluctuations and provide a stable reference for assessing climate conditions.[13] Using annual values rather than multi-year averages conflates this short-term noise with any remaining background variability that EPA claims is relevant for its assessment, artificially inflating the variability estimate EPA then used to declare the policy signal de minimis.

This error is particularly glaring because time data is inherently always averaged in some way, whether it be daily, monthly, seasonally, annually, or multi-annually. As such, EPA is already using averaged data; the Agency cites 12-month average global mean surface temperature anomalies data. EPA could more accurately represent long-term temperature changes by averaging over a longer period, in accordance with best practices of climate science.

Furthermore, as discussed in Section 1.a., EPA did not correct for the well-documented upward trend in global mean surface temperature before calculating standard deviation. Because the trend was not removed, the standard deviation of the annual values not only represents both genuine year-to-year variability, but also the directional movement of the underlying trend, inflating the resulting figure. A standard approach in climate time series analysis, referred to as filtering out high frequency noise, is to separate long-term trends from higher-frequency noise prior to estimating variance.[14,15,16]

To illustrate the consequences of EPA's methodological choices, here we recalculate temperature variability using longer averages. To be clear, we are not suggesting that a correct approach would be to use a 10-year window as opposed to annual data, but to illustrate how the standard deviation is sensitive to the period the data is averaged over. We calculated 10-year average global mean surface

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[13] NOAA National Centers for Environmental Information (NCEI). (2019, August 2). *New type of U.S. Normals addresses influence of El Niño and La Niña.* Accounting for Variability in Our Changing Climate. https://www.ncei.noaa.gov/news/accounting-natural-variability-our-changing-climate

[14] Storch, H. V., & Zwiers, F. W. (1999). *Statistical analysis in climate research* (pp. 10–11, 197–215). Cambridge University Press

[15] Brockwell, P. J., & Davis, R. A.

[16] García-Carreras, B., & Reuman, D. C. (2013). Are Changes in the Mean or Variability of Climate Signals More Important for Long-Term Stochastic Growth Rate? *PLoS ONE*, *8*(5), e63974. https://doi.org/10.1371/journal.pone.0063974

temperature anomaly data from the same annually averaged NOAA NCEI Climate at a Glance data used by EPA;[17] fit a linear least squares regression to the data and subtracted the resulting trend line, retaining only the residuals; and then calculated the standard deviation of the residuals. This approach, described above, is well established in climate science and separates out the long-term trend from the short-term noise.

Using 10-year averages for temperature anomaly and time with the long-term trend removed via linear least square regression, the sample standard deviation is 0.0515°C, roughly 63% lower than EPA's reported "variability" statistic of 0.14°C (Figure 6). Using 10-year averages for temperature and CO_2 concentration with the long-term trend removed via linear least square regression, the sample standard deviation is 0.0208°C, roughly 85% lower than EPA's reported "variability" statistic of 0.14°C (Figure 7). These results demonstrate that EPA's choice of annual averages, combined with its failure to detrend, produced a statistically inappropriate estimate that overstates variability by as much as 85%.

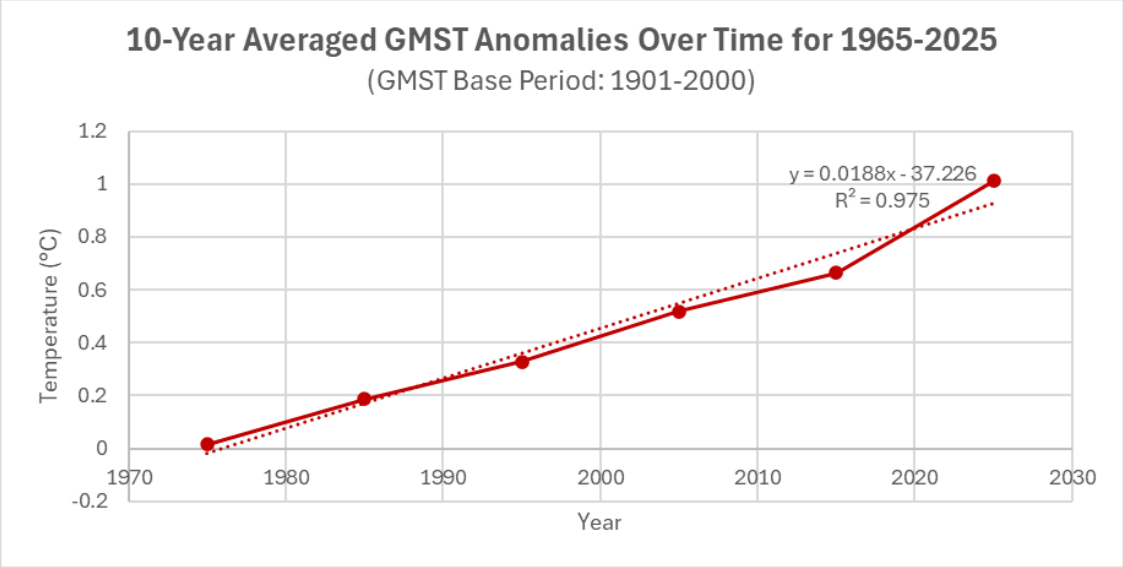

Figure 6. *10-year average global mean surface temperature (GMST) anomalies (°C) with respect to the 1901-2000 average vs. time for 1965-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. Each dot represents the average temperature anomaly for the previous 10-year period. For example, the dot at 1975 represents the mean temperature anomaly compared to the 1901-2000 average for the years 1966-1975. The dotted line is the line of best fit, which shows that GMST anomalies have increased during this period by a rate of roughly 0.019°C/year.*

[17] NOAA NCEI. *Climate at a Glance: Global Time Series*

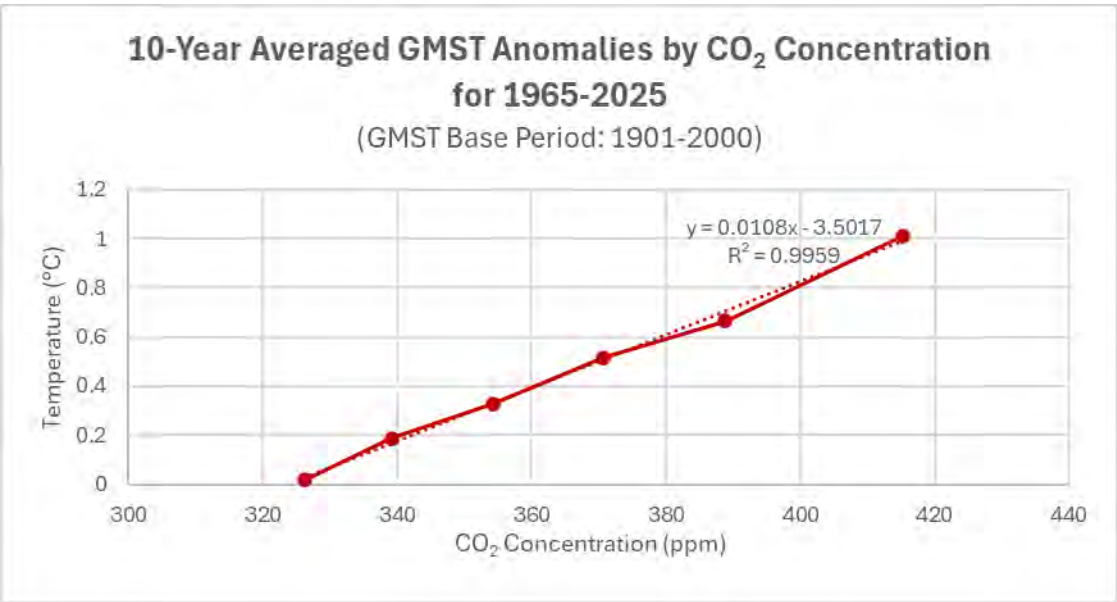

Figure 7. *10-year average global mean surface temperature (GMST) anomalies (°C) with respect to the 1901-2000 average vs. carbon dioxide (CO_2) concentration (ppm) for 1965-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. CO_2 data was sourced from NASA for the years 1965-2011 (the most recent year available) and from the NOAA Global Monitoring Lab for the years 2012-2025. Each dot represents the average temperature anomaly and average CO_2 concentration for the previous 10-year period. The dotted line is the line of best fit, which shows that GMST anomalies have increased during this period by a rate of roughly 0.011°C/ ppm CO_2.*

C. EPA should have used population standard deviation and not sample standard deviation if they meant to describe "variability" for 2016-2025

The premise of EPA's argument that natural climate variability is large relative to the projected temperature impact of U.S. motor vehicle GHG standards depends critically on how variability is measured. EPA calculated a 0.14°C "variability" figure for the 2016-2025 period. It is unclear if the Agency did so with the intent to measure standard deviation in this period alone (i.e., the population of data is restricted to the 2016-2025 data), or if they were using the 2016-2025 period to represent the entirety of data from 1950-2025 (i.e., the 2016-2025 data is only a sample). For the purposes of this section, our interpretation of EPA's inadequately short description is that the Agency intended to represent just the variability of 2016-2025.

The distinction between population and sample standard deviation relies on a fundamental question: are the data points in question a sample drawn from a larger population, or do they constitute the entire population of interest? The formula for calculating sample standard deviation divides by the number of observations minus one (n-1) to account for the bias introduced when a sample mean is used to estimate an unknown population mean.[18] This adjustment is appropriate when the observed values are a subset of a larger group that was not fully observed, as is often the case with climate

[18] El Omda, S., & Sergent, S. R.

data.[19] Conversely, population standard deviation divides by the number of observations (n) and is appropriate when the observed values constitute the complete population, such as a fully enumerated set of observations within a defined temporal window where all elements of interest are observed without sampling uncertainty (i.e., a closed set of annual GMST values over a specified period).

In the case of EPA's variability calculation, first we will assume that the Agency's intention was to calculate variability of the ten annual global mean surface temperature values from 2016-2025. As such, these data can be understood as fully observed measurements of a specific, completely enumerated set of years. There is one Earth, and its average global mean surface temperature for each of those years has been measured and recorded. There is no larger population of unobserved years from which these 10 values were drawn; they are the population. EPA therefore should have divided by n=10 rather than n-1=9 when calculating the standard deviation of these values. Here, we proceed as EPA should have to quantify the impacts of its error. Population standard deviation equals sample standard deviation multiplied by $\sqrt{(n-1/n)}$. With n=10, this adjustment factor is $\sqrt{(9/10)} \approx 0.9487$, meaning EPA's reported variability figure of 0.14°C should be reduced to approximately 0.133°C to adjust for this error alone, or a reduction of approximately 5.4%.

For the sake of consistency with EPA's methods, throughout this technical memorandum, we reported standard deviations as calculated using the sample standard deviation formula. Here we recalculate these using the population standard deviation formula (Table 1).

Table 1. *Comparison of standard deviation estimates when calculating using the formula for sample standard deviation vs. population standard deviation.*

Data	Figure	Sample Standard Deviation of the Residuals (°C)	Population Standard Deviation of the Residuals (°C)
EPA's variability estimate	-	0.14	0.133
Recent GMST annual anomalies over time (2016-2025)	Figure 4	0.1073	0.1018
Recent GMST annual anomalies with CO_2 concentrations (2016-2025)	Figure 5	0.1049	0.0995
10-year averaged GMST anomalies with time (1965-2025)	Figure 6	0.0515	0.0477
10-year averaged GMST anomalies with CO_2 concentrations (1965-2025)	Figure 7	0.0208	0.0193

[19] Storch, H. V., & Zwiers, F. W. Chapter 4: Concepts in Statistical Inference.

D. The use of EPA's selected time period, 2016-2025, was inadequately considered, and is particularly unsupportable if intended to represent "variability" in 1950-2025

If, in fact, EPA was using the 2016-2025 period to represent the entirety of data from 1950-2025 (i.e., the 2016-2025 data is only a sample), EPA's decision was still arbitrary. The Agency provided no explanation for why the period from 2016-2025 was selected as the reference period, nor any sensitivity analysis showing how the results would change under alternative window choices. As we show here, a more representative reference window would produce a lower variability estimate.

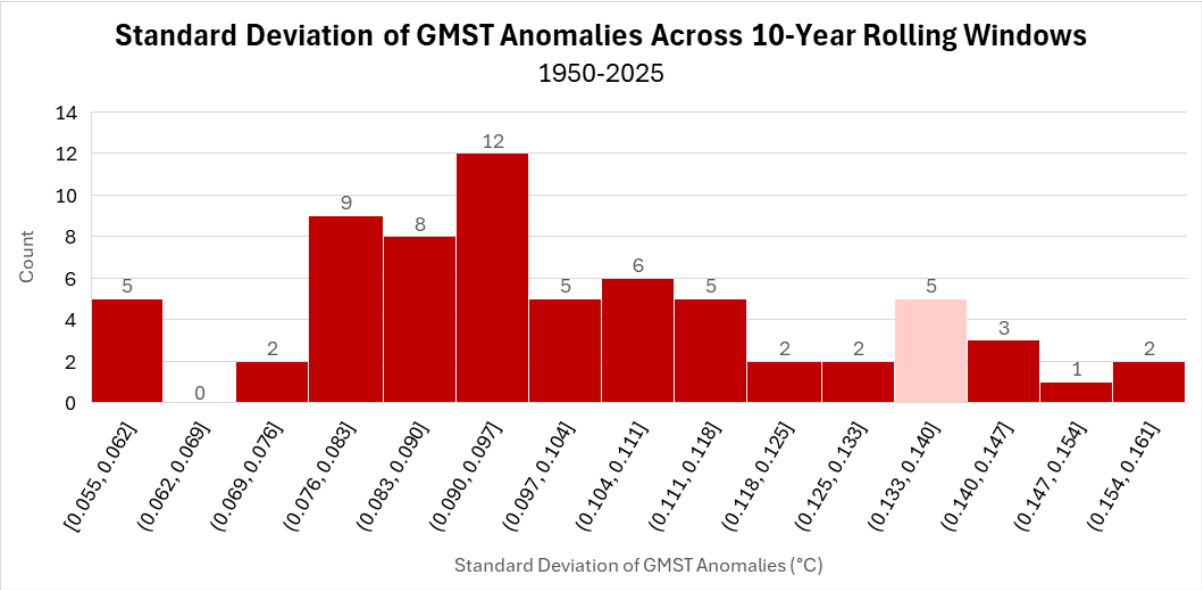

Figure 8. *Standard deviation of GMST anomalies (°C) across 10-year rolling windows from 1950-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. The lightest-hued bin contains the standard deviation for 2016-2025: 0.136°C. Only seven of the 67 windows have standard deviations above that of the 1950-2025 period.*

To evaluate how consequential this choice is, we calculated the standard deviation of GMST anomalies for each 10-year rolling period (i.e. 1950-1959, 1951-1960, etc.) from 1950-2025. This produced 67 distinct 10-year windows, each with its own standard deviation. We calculated the sample standard deviation for the anomalies in global mean surface temperature for the period 2016-2025 to be 0.136°C. As shown in Figure 8, the sample standard deviation for the 2016-2025 window is among the highest of all windows examined.[20] Of the 67 rolling 10-year windows calculated, only seven produced a higher sample standard deviation than the 2016-2025 period. In other words, EPA's chosen reference window falls in roughly the top 10% of all possible 10-year windows in terms of internal variability. By selecting, without justification, one of the most internally variable 10-year periods in the modern temperature record (Figure 8), EPA has systematically overstated the background variability against which the policy signal of 0.037°C is being compared. Had EPA

[20] We plotted the data with a range of bin sizes, which did not meaningfully impact the shape of figure or the conclusions drawn from Figure 8.

chosen a more typical window, the resulting standard deviation would have been meaningfully lower. For example, had EPA chosen a 10-year window containing the median year (1992), such as the 1987-1996 window, the resulting sample standard deviation would have been 0.0766°C, roughly 45% lower than EPA's calculated value of 0.14°C. If EPA had chosen the window with the median sample standard deviation in the 1950-2025 period, the Agency would have selected the 1981-1990 window, which has a sample standard deviation of 0.0962°C, roughly 31% lower than EPA's calculated value of 0.14°C.

EPA's choice of 2016-2025 as the reference window is not merely arbitrary; it is systematically biased toward a period of historically anomalous climate behavior. The IPCC Special Report on Global Warming of 1.5°C found that, "trends in the intensity and frequency of some climate and weather extremes have been detected over time spans during which about 0.5°C of global warming occurred."[21] This finding has direct implications for EPA's choice of reference window. The 2016-2025 period coincides with some of the highest recorded GHG concentrations in human history.[22] At these elevated GHG concentrations, the climate system is operating in a regime that is measurably different from earlier decades, with altered patterns of climate extremes that are themselves a consequence of the underlying warming trend. By selecting a reference window that falls within this altered climate regime, and without correcting for the underlying trend that produced it, EPA has compounded the error identified in Section 1.a.: not only did the Agency fail to detrend the temperature series, but it selected a window in which the residual variability is itself partially a product of the trend it failed to remove. In other words, the elevated variability of the 2016-2025 window relative to earlier periods is not purely a reflection of natural internal climate variability. It is at least partly a reflection of the altered climate state produced by the very GHG emissions whose regulation is under consideration. Using this window to argue that climate variability renders US motor vehicle GHG regulation futile is therefore circular: the elevated variability EPA cites as a reason not to regulate is itself a consequence of the kind of emissions that section 202(a) GHG regulation is meant to address.

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[21] Hoegh-Guldberg, O., D. Jacob, M. Taylor, M. Bindi, S. Brown, I. Camilloni, A. Diedhiou, R. Djalante, K.L. Ebi, F. Engelbrecht, J. Guiot, Y. Hijioka, S. Mehrotra, A. Payne, S.I. Seneviratne, A. Thomas, R. Warren, and G. Zhou, 2018: Impacts of 1.5ºC Global Warming on Natural and Human Systems. In: 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.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 175-312. https://doi.org/10.1017/9781009157940.005

[22] Rohde, R. (2026, January 14). *Global Temperature Report for 2025 - Berkeley Earth*. Berkeley Earth. https://berkeleyearth.org/global-temperature-report-for-2025/

E. EPA did not adequately consider the impacts of a 10-year time interval on variability.

EPA's decision to characterize climate variability using a 10-year time interval is a consequential methodological choice that was made without justification. As shown in Figure 9, the choice of window length materially affects the resulting standard deviation estimate. We are not suggesting that a 10-year window is an appropriate window length to use to characterize variability, but rather, as shown in Figure 9, to illustrate how the window length selected considerably affects the final variability estimate. This suggests that the basic methodological approach undertaken by EPA is arbitrary. This arbitrariness is compounded by the fact that EPA's specific 10-year window of 2016-2025 is itself an outlier within the distribution of all possible 10-year windows, as shown in Figure 8 and discussed in Section 1.d.

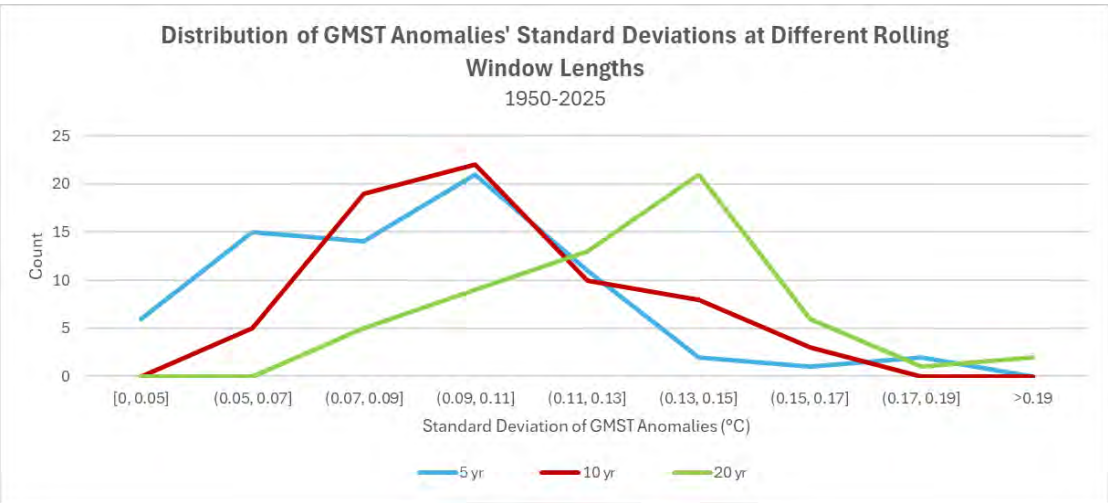

Figure 9. *Distribution of GMST anomalies' standard deviations (°C) at different rolling window lengths. Data is not detrended. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. The light blue line shows the distribution of standard deviation for rolling 5-year windows, while the red and green lines show the distributions for 10- and 20-years respectively. This shows how standard deviation is sensitive to window length.*

The same pattern holds for 5-year windows. Generally, the sample standard deviation for 5-year windows is smaller (Figure 9), but the most recent 5-year window of 2021-2025 has a sample standard deviation of 0.177°C, making it among the single most variable 5-year window in the 1950-2025 record (Figure 10). In other words, regardless of which interval length is used, EPA's choice of the most recent available window consistently produces one of the highest variability estimates in the historical record. The combination of an unjustified interval length and an unjustified window selection systematically biases EPA's variability estimate upward relative to what a different methodological choice would produce.

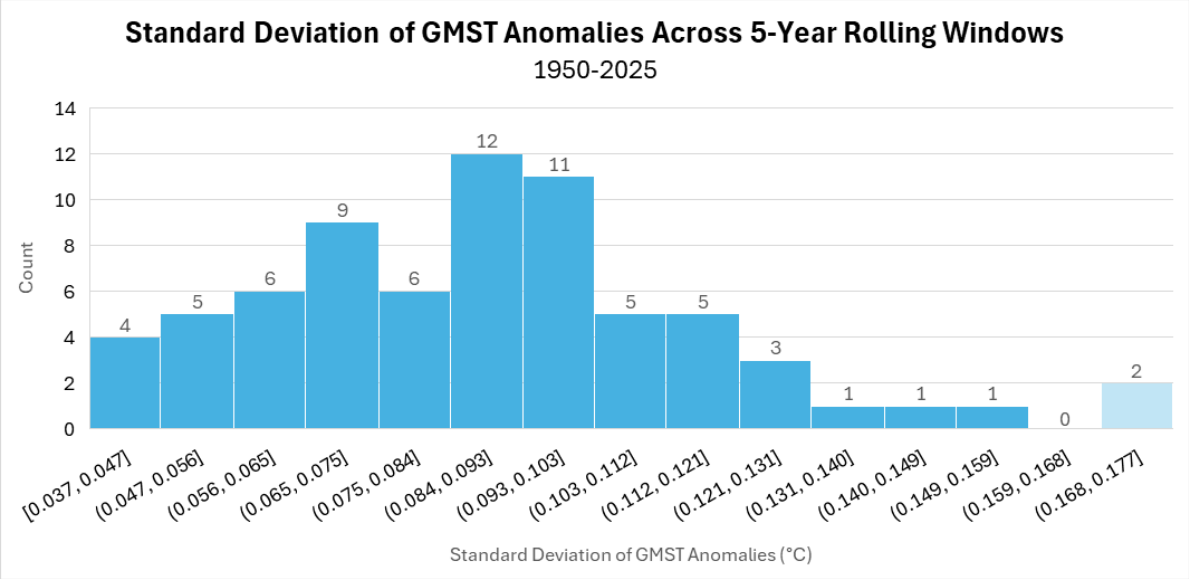

Figure 10. *Standard deviation of GMST anomalies (°C) across 5-year rolling windows from 1950-2025. GMST data was sourced from the NCEI Climate at a Glance: Global Time Series. The lightest-hued bin contains the standard deviation for 2021-2025: 0.177°C. The 2021-2025 window has the highest standard deviations in the 1950-2025 period.*

EPA provided no explanation for why a 10-year interval was selected, nor any sensitivity analysis demonstrating that the conclusions are robust to alternative interval lengths. Given that the choice of interval length shifts the center of the standard deviation distribution by as much as 0.04-0.05°C, this omission is significant.

II. Measurability

EPA's assertion that global mean surface temperature and global sea level rise ranges of measurability are larger than the EPA's projected impacts is completely unsupported and fundamentally arbitrary. For global mean surface temperature, the source EPA cites does not include the information they claim it does, the paper with similar numbers to EPA's has been updated to reduce the uncertainty, and there are at least six global annual temperature datasets with uncertainties below EPA's 0.037°C. For global sea level rise, EPA fails to provide any source or any number and available estimates of measurement uncertainty are below the 1.4 cm of global sea level rise EPA projects.

In the Final Rule, EPA says:

> [T]he predicted impacts through 2100 (0.013 °C[sic] as shown in Table 5) are below the range of measurability for GMST and likewise for GSLR (1.4 cm as shown in Table 7).[181]
>
> [181]See National Oceanic and Atmospheric Administration (NOAA), National Centers for Environmental Information, Global Surface Temperature Anomalies-Methodology and

Uncertainty, estimating uncertainty in annual global mean surface temperature of approximately ±0.05 °C since 1950, increasing to ±0.1–0.2 °C in the late 19th Century. Available at https:// www.ncei.noaa.gov/access/monitoring/global-temperature-anomalies.[23]

A. EPA's use of measurement uncertainty as a metric for establishing futility is arbitrary.

EPA's choice to use "measurability" as a metric to determine futility is arbitrary. Measurement uncertainty for global mean surface temperature and global sea level rise arises from many components including instrument precision, data coverage, and statistical methods to fill in data globally.[24] In practice, this means that global temperature estimates must account for the uneven distribution of weather stations and ocean buoys across the planet, gaps in historical records, differences in measurement techniques over time, and the challenge of converting thousands of local temperature readings into a single planetary average.[25] For GMST specifically, uncertainty stems from multiple independent sources across both land and ocean records. On land, these include station uncertainty (e.g., measurement errors, transcription errors, and adjustments to station records), bias uncertainty (e.g., changes in instrumentation methodology over time and urban heat island effects), and sampling uncertainty (from incomplete spatial and temporal coverage).[26] Over the ocean, uncertainty is further broken down into parametric uncertainty and reconstruction uncertainty, the latter of which "averages out to nearly zero at global scales."[27]

Over time, these uncertainties have generally declined as instruments have gotten more precise, data coverage has improved, and statistical methods have progressed.[28] EPA fails to explain why this trend would not continue leading to smaller measurement uncertainties by 2100. This omission is particularly striking given EPA's own acknowledgement that GMST uncertainty has decreased by up to 75% since the "late 19th century," indicating that the measurability metric is contingent on a moving target rather than a fixed scientific constraint.

B. Global mean surface temperature measurability

i. EPA's source does not include any information about temperature measurement uncertainty.

[23] 91 Fed. Reg. 7733 (Feb. 18, 2026):
[24] NASA. (2025, January 10). *This is How Scientists Measure Global Temperature.* Nasa.gov. https://science.nasa.gov/earth/measuring_global_temperature/
[25] *Ibid.*
[26] Lenssen, N. J. L., Schmidt, G. A., Hansen, J. E., Menne, M. J., Persin, A., Ruedy, R., & Zyss, D. (2019). Improvements in the GISTEMP uncertainty model. Journal of Geophysical Research: Atmospheres, 124, 6307–6326. https://doi.org/10.1029/2018JD029522
[27] Lenssen et al. 2019
[28] NASA. *This is How Scientists Measure Global Temperature.*

The source EPA provides in the Final Rule (quoted above) redirects to a different NCEI webpage: https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/data-info. On this webpage, there is no discussion of measurement uncertainty, and the values EPA references are not included at any point in the cited webpage. EPA's failure to provide the actual source used to establish such a consequential number in the Rule is inexcusable and fundamentally arbitrary. EPA also fails to establish what the range in temperature provided, ±0.05°C and ±0.1-0.2°C, is describing. For example, whether it is describing uncertainty at the one standard deviation (1σ) level, at the 90% or 95% confidence interval, or in some other way. Given the utter lack of information provided by EPA, we were unable to reconstruct EPA's measurement uncertainty figures based on the reference EPA provided.

ii. The dataset referenced in EPA's citation includes materially lower uncertainties from the ones EPA states

One of the datasets referenced in footnote 181 is NOAAGlobalTemp (NGT).[29] We could not find information about the uncertainty in temperatures for version 6 of NGT, the most recent version which was released in February 2024. In the version 6 text datasets,[30] the uncertainty values are all marked as -999, a common way to mark data points as missing or unknown. It is possible that the maintainers of NGT have not yet finished calculating the uncertainty for version 6 of the data.

However, for version 5, which was released in June 2019, we identified a paper entitled "Uncertainty Estimates for Sea Surface Temperature and Land Surface Air Temperature in NOAAGlobalTemp Version 5" by Huang et al. published in January 2020.[31] In this paper, Huang et al. describe how they calculate the uncertainty for the NGT v5 and conclude that total uncertainty of globally averaged surface temperature is "0.05°–0.07°C for 1880–1900 and decreases gradually to approximately 0.02°C in the 2010s except for spikes during the two world wars." This is shown graphically in figure 10 of the paper, pasted below as Figure 11. The uncertainty values presented in this paper are reported as 1σ values, including the values stated above and shown in Figure 11.[32]

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[29] Huang, B., X. Yin, M. J. Menne, R. Vose, NOAA Global Surface Temperature Dataset (NOAAGlobalTemp), Version 6.1.0 Time Series. NOAA NCEI. https://doi.org/10.25921/vvaa-wq11.

[30] All files: https://www.ncei.noaa.gov/data/noaa-global-surface-temperature/v6.1/access/timeseries/; Example with -999s: https://www.ncei.noaa.gov/data/noaa-global-surface-temperature/v6.1/access/timeseries/aravg.ann.land.90S.20S.v6.1.0.202602.asc

[31] Huang, B., Menne, M. J., Boyer, T., Freeman, E., Gleason, B. E., Lawrimore, J. H., Liu, C., Rennie, J. J., Schreck, C. J., III, Sun, F., Vose, R., Williams, C. N., Yin, X., & Zhang, H. (2020). Uncertainty Estimates for Sea Surface Temperature and Land Surface Air Temperature in NOAAGlobalTemp Version 5. *Journal of Climate*, *33*(4), 1351-1379. https://doi.org/10.1175/JCLI-D-19-0395.1

[32] It is possible these values are actually the 95% confidence interval, or 2σ values. In Lenssen et al. 2024, discussed more below, they calculated the 95% CI for a number of different global temperature datasets including NGT. The values Lenssen et al. 2024 report as the 95% CI appear to match the values reported by Huang et al. 2020 as 1σ. This distinction is immaterial for the purposes

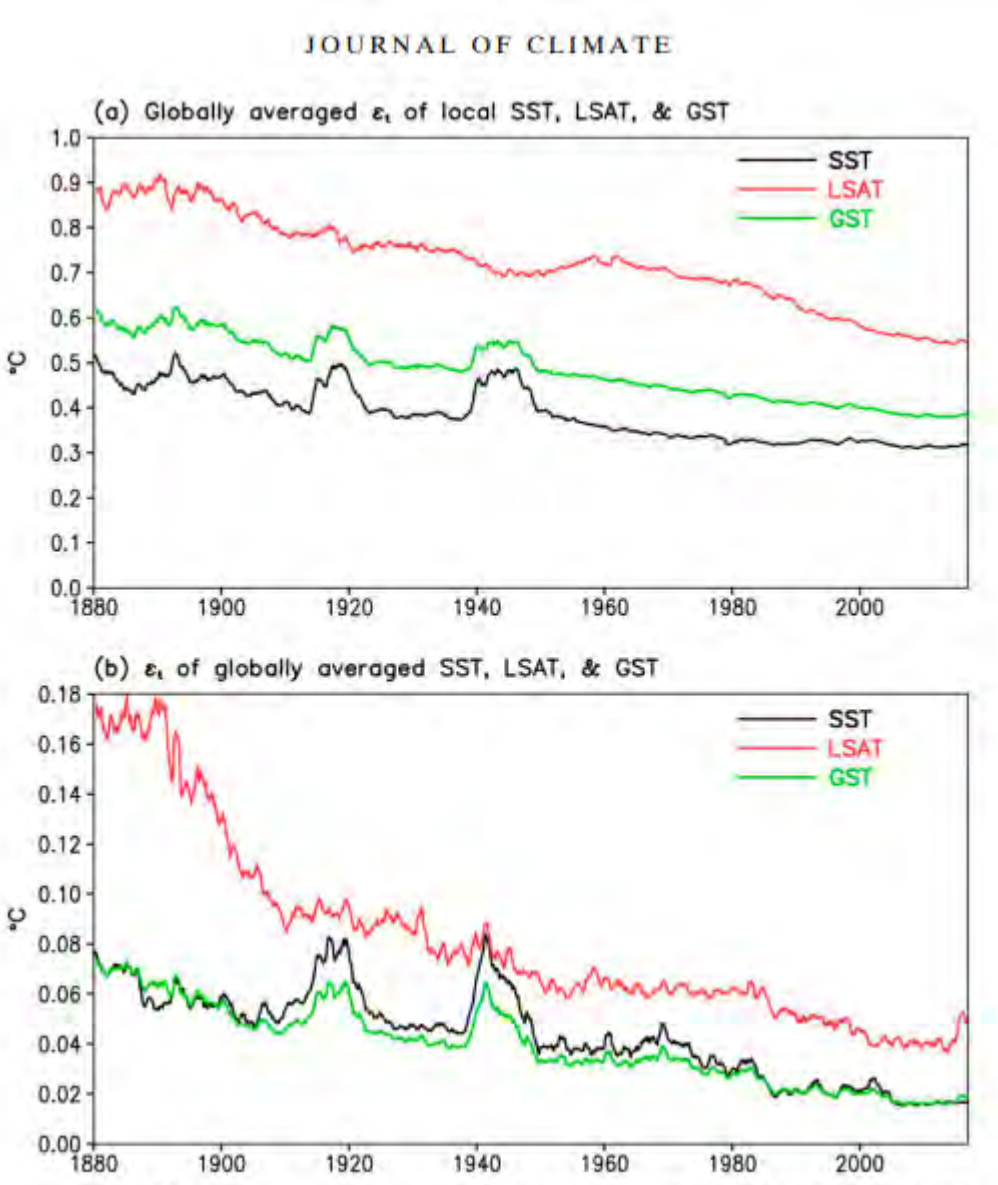

FIG. 10. (a) Globally averaged total uncertainty (1σ) of local SST (black), LSAT (red), and GST (green), and (b) total uncertainty (1σ) of globally averaged SST, LSAT, and GST. A 12-month running filter is applied in plotting.

Figure 11. *Figure copied from Huang et al. 2020. The green line in panel (b) displays the relevant uncertainty.* ε_T *represents the total uncertainty. SST: sea surface temperature, LSAT: land surface air temperature, GST: global surface temperature.*

It is important to note that 0.02°C is lower than EPA's projected global mean surface temperature impact from US vehicle GHGs in 2100 of 0.037°C. In other words, the dataset attached to the webpage EPA cites reports a global surface temperature uncertainty lower than EPA's projected

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of this memo since EPA fails to identify what confidence interval they believe should be used nor do they provide any justification.

GMST impact, directly contradicting EPA's conclusion that US vehicle GHG impacts are de minimis and that section 202(a) GHG regulation is futile.

iii. The paper with values that match EPA's stated range of measurability has been updated to have uncertainties below 0.037°C

While it is not clear what EPA meant to reference to get its "range of measurability" values given they do not match the data that is referenced in the Agency's citation, the values it states appear to match a statement from the abstract of Lenssen et al. 2019, "The resulting 95% uncertainties are near 0.05°C in the global annual mean for the last 50 years and increase going back further in time reaching 0.15°C in 1880."[33] This paper described the uncertainty values for NASA's GISTEMP dataset. However, since 2019, the uncertainty for GISTEMP has been updated as detailed in Lenssen et al. 2024.[34] The resulting uncertainties are significantly lower than the values from the 2019 paper (Figure 12). Between 1950 and 2020, the average global annual uncertainty was 0.055°C for Lenssen 2019 and 0.035°C for Lenssen 2024. Forty-one of the annual uncertainties in Lenssen 2024 are below 0.037°C while none of the uncertainties from Lenssen 2019 where lower than 0.04°C.

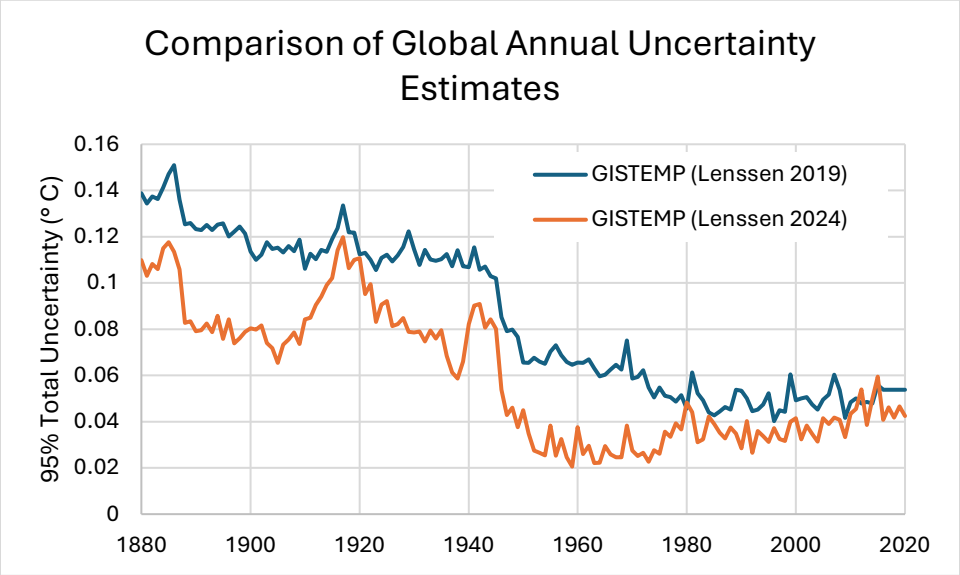

Figure 12. *Global annual uncertainty estimates for 1880 to 2020 from two versions of the GISTEMP data and two corresponding papers, Lenssen et al. 2019 and Lenssen et al. 2024.*

[33] Lenssen, N. et al. Improvements in the GISTEMP Uncertainty Model.
[34] Lenssen, N., Schmidt, G. A., Hendrickson, M., Jacobs, P., Menne, M. J., & Ruedy, R. (2024). A NASA GISTEMPv4 observational uncertainty ensemble. *Journal of Geophysical Research: Atmospheres*, 129, e2023JD040179. https://doi.org/10.1029/2023JD040179

iv. Additional datasets of global mean surface temperature have measurement uncertainty values materially lower than EPA's stated range of measurability

In addition to the datasets discussed above, there are many additional global annual temperature datasets that report uncertainties lower than EPA's 0.037°C for some or all of the last 75 years.[35] Figure 13 shows the number of years since 1950 and since 1970 that each dataset has had global annual uncertainties below 0.037°C. Figure 14 shows the average uncertainty of global annual mean temperature since 1950 and since 1970. For each of the datasets, one or both of the averages are below 0.037°C and for some of them, the average is substantially below 0.037°C, for instance the average since 1970 for DKRZ is 0.017°C (Figure 14).

[35] The data for NOAA GlobalTemp, GISTEMP (Lenssen 2024) and DKRZ are from Lenssen et al. 2024 and correspondence with the authors for the underlying data for Figure 4 in the paper; Berkeley Earth data: Rohde, R. A. & Hausfather, Z. (2020). *The Berkeley Earth Land/Ocean Temperature Record*, Earth Syst. Sci. Data, 12, 3469ï¿½3479, https://doi.org/10.5194/essd-12-3469-2020. Retrievable at: https://berkeley-earth-temperature.s3.us-west-1.amazonaws.com/Global/Land_and_Ocean_summary.txt; HadCRUT5 data is "Global Annual Ensemble Means and Uncertainties" retrievable at: https://www.metoffice.gov.uk/hadobs/hadcrut5/data/HadCRUT.5.1.0.0/download.html; DCENT data is "Global Annual Time Series" retrievable at: https://dcent-i.github.io/#access; The uncertainty values for all of the datasets except DCENT are 95% CI. DCENT only provides a 1 standard deviation confidence interval. As discussed above in footnote 32, the NOAA GlobalTemp data was calculated from ensemble members for the Lenssen 2024 paper as 95% CI but visually matches the 1 standard deviation data in the Huang 2020 paper. The uncertainty values calculated by Lenssen 2024 are included in the figures in this section.

[35] Because of how Berkeley calculates their five-year uncertainty, they do not report 2023 or 2024 values.

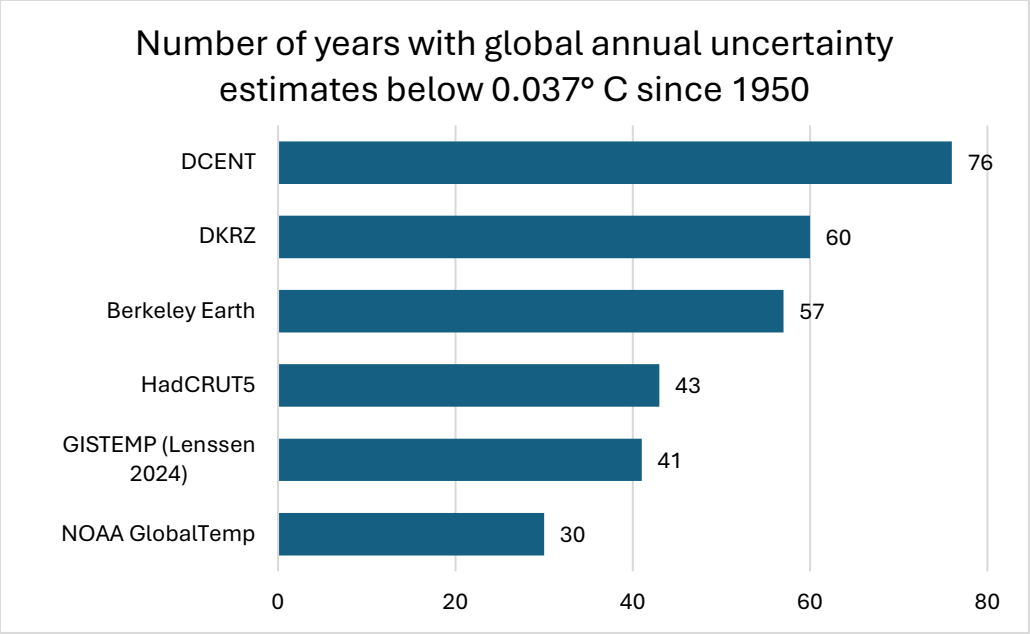

Figure 13. *Number of years with global annual uncertainties below 0.037° C since 1950 for six different datasets. Most of the uncertainties presented at 95% CI. DCENT only provides 1 standard deviation confidence intervals. See footnote 31 and 34 for more discussion about NOAA Global Temp.*

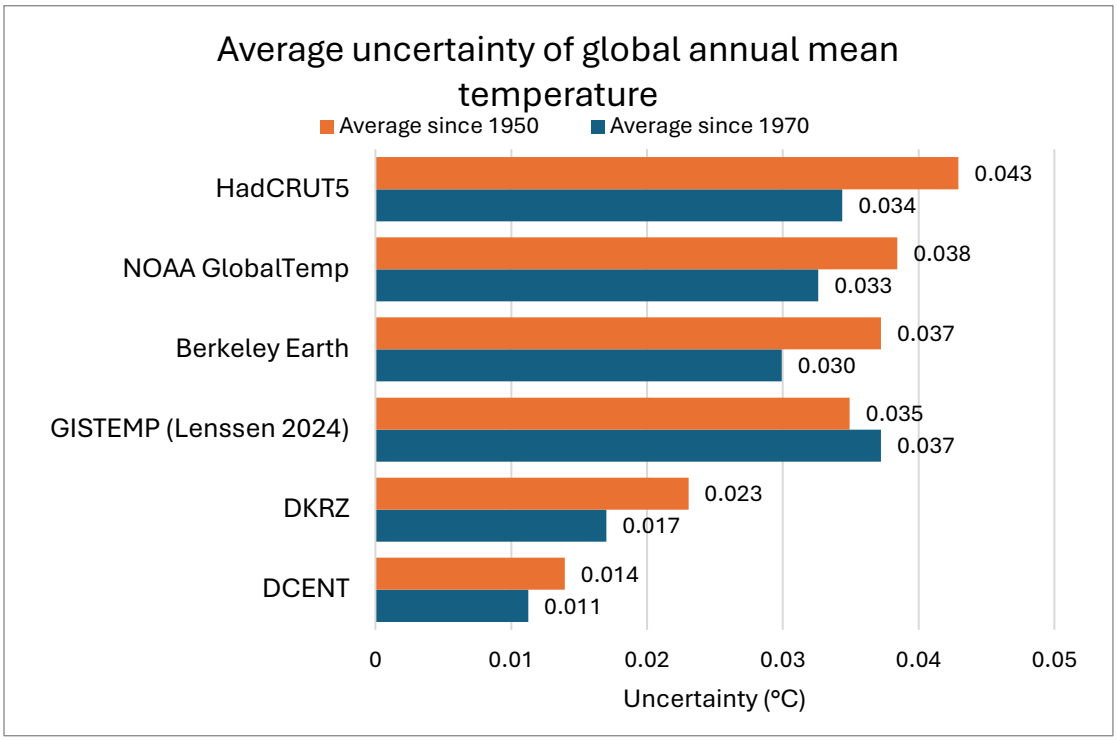

Figure 14. *Average uncertainty for global annual mean temperature for six different datasets. The averages are taken from 1950 to 2025 and from 1970 to 2025. Not all datasets have all of the recent years of data. Most of the uncertainties presented at 95% CI. DCENT only provides 1 standard deviation confidence intervals. See footnote 31 and 34 for more discussion about NOAA GlobalTemp.*

v. EPA should have considered the uncertainty for longer time frames

The signal represented by the warming from US onroad vehicle GHG emissions is long term, the temperature increase will not appear in 2100 and then suddenly disappear. As such, EPA should have considered the uncertainty for a longer time frame and not annual uncertainty. Since some of the uncertainty is uncorrelated and independent,[36] when the uncertainty over several years is calculated it is lower than the annual uncertainty. Berkeley Earth includes a five-year uncertainty that is, on average since 2000, 16% lower than their annual uncertainty and an average of 21% lower since 1975. Every year since 1966 has a five-year uncertainty lower than 0.037°C (Figure 15).[37]

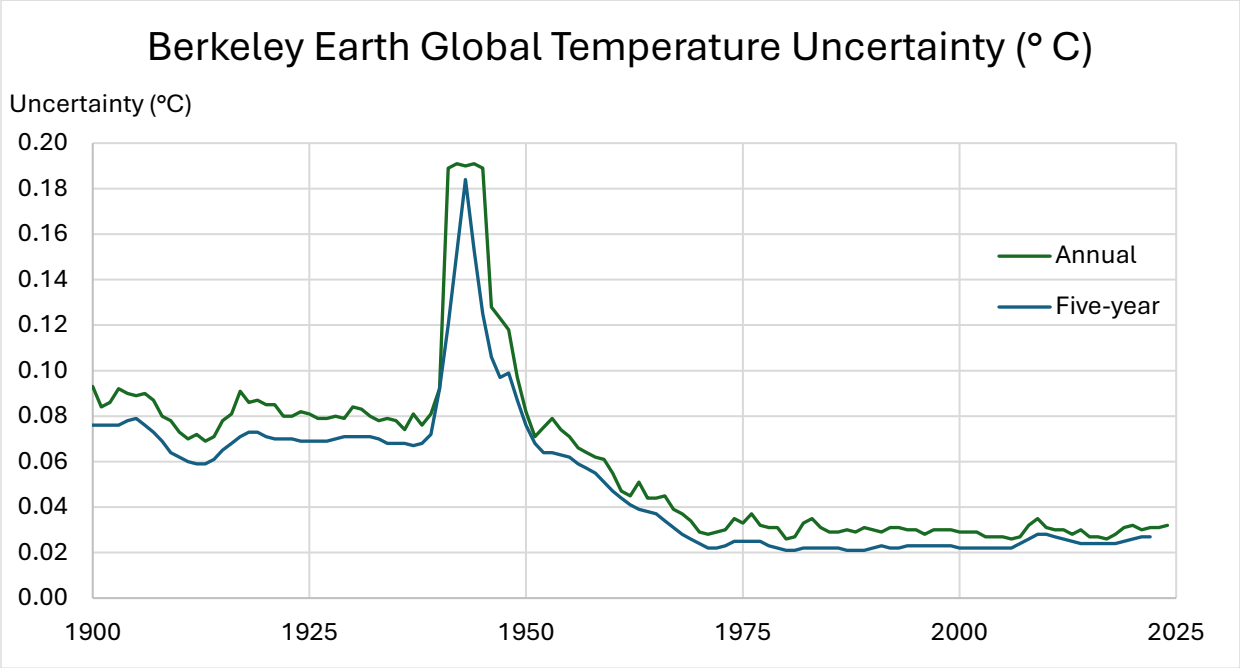

Figure 15. *Annual and five-year global temperature uncertainties from Berkeley Earth, 1900 to 2025.*

C. For sea level measurability, EPA fails to provide any value and the measurement uncertainty values we identified are much smaller than 1.4 cm

For sea level measurability, EPA did not provide an uncertainty value or any source for its claim that the measurability is larger than 1.4 cm. In fact, the sources we found state a much lower uncertainty for global average sea level measurements. For more than three decades, satellite altimeters have used radar to precisely measure sea surface height. The measurements have an uncertainty of around

[36] This is not true for all of the components of the uncertainty and so the reduction is not the square root of the number of values being averaged (root sum square) which would be the case if the uncertainty was purely independent.

[37] Rohde, R. A. & Hausfather, Z. *The Berkeley Earth Land/Ocean Temperature Record.*

4mm or 0.4cm, well below the 1.4cm EPA projected in 2100. This data represents uncertainty at the 90% confidence interval.[38]

III. Conclusion

This memorandum demonstrates that EPA's futility analysis is fundamentally flawed in both its assessment of temperature variability and its claims regarding measurability. In each case, EPA's methodological choices systematically biased the analysis toward overstating the barriers to regulatory significance.

With respect to temperature variability, EPA committed multiple methodological errors: (1) failure to correct for the underlying increasing trend in global mean surface temperature; (2) use of inappropriately short annual averages to assess whether an increase in temperature would be inconsequential given the "variability" in the system; (3) the potentially erroneous calculation of population standard deviation and not sample standard deviation; (4) the arbitrary use of the selected time period, 2016-2025, which is particularly unsupportable if intended to represent "variability" in 1950-2025; and (5) the arbitrary use of a 10-year time interval to calculate variability. Each of these errors inflates EPA's variability estimate. Taken together, they cause EPA to overstate temperature variability by as much as 85%.

With respect to measurability, EPA's analysis is also flawed. EPA cited a source that does not contain the uncertainty values it claims to rely upon. The dataset most plausibly associated with EPA's figures has since been updated, and under its revised uncertainty estimates, EPA's projected global mean surface temperature impact exceeds the average uncertainty for the global annual mean temperature for the past 75 years. Multiple independent global temperature datasets report annual measurement uncertainties that are, on average, below EPA's projected 0.037°C impact—and 5-year averaged uncertainties that are even lower. For global mean sea level, EPA provided no source for its 1.4cm measurability threshold. The best available satellite altimetry data reports uncertainties of 0.4cm, more than three times smaller.

In sum, EPA's conclusion that section 202(a) GHG regulation is futile rests on a variability metric that overstates background temperature noise by as much as 85% and a measurability metric that is unsupported by the scientific sources EPA cites. Even accepting EPA's basic framework for assessing futility, the Agency's own projected policy impact of 0.037°C is not de minimis when

[38] NASA. (n.d.). *Key Indicators: Global Mean Sea Level*. NASA Sea Level Change Portal. https://sealevel.nasa.gov/understanding-sea-level/key-indicators/global-mean-sea-level/; Willis, J. K., S. Fournier, K. Marlis, and E. Killett. 2025. NASA-SSH Global Mean Sea Level from Simple Gridded Sea Surface Height. Ver. 1. PO.DAAC, CA, USA. at https://doi.org/10.5067/NSIND-GMSV1; Ablain, M., Meyssignac, B., Zawadzki, L., Jugier, R., Ribes, A., Spada, G., Benveniste, J., Cazenave, A., & Picot, N. (2019). Uncertainty in satellite estimates of global mean sea-level changes, trend and acceleration. *Earth System Science Data*, *11*(3), 1189–1202. https://doi.org/10.5194/essd-11-1189-2019

properly evaluated against adjusted variability and measurability estimates. The Final Rule's futility determination therefore is fatally flawed and should be reconsidered.

APPENDIX D

Modeling the Sea-Level Change from U.S. Vehicle Emissions

Modeling the Sea-Level Change from U.S. Vehicle Emissions

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Abstract

Recent U.S. Environmental Protection Agency (EPA) analyses have argued that greenhouse gas emissions from U.S. on-road vehicles contribute negligibly to global mean sea-level rise (GMSLR). Here, I replicate and extend the EPA's modeling framework using the FaIR climate model coupled with the BRICK sea-level model, incorporating a probabilistic weighting approach and a longer model timescale to better represent joint climate-sea-level uncertainty. In addition to the baseline SSP2-4.5 scenario and an EPA-consistent emissions reduction case, I examine alternative scenarios reflecting stalled technological progress and a counterfactual pre-regulation vehicle fleet. Results reproduce EPA estimates of approximately 1-2 cm of GMSLR reduction by 2100 under vehicle emissions mitigation but show that these differences grow substantially over multi-century timescales, exceeding 6 cm by 2200. Downscaling to U.S. coastlines reveals larger local effects, particularly along the Gulf of Mexico Coast. These findings highlight the long-term and regionally amplified benefits of emissions reductions from the transportation sector.

1 Introduction

In February 2026, the United States Environmental Protection Agency (EPA) repealed its 2009 Greenhouse Gas Endangerment Finding and along with it, its Motor Vehicle Greenhouse Gas Emissions Standards Under the Clean Air Act.[1] The justification for this relied partially on computational modeling to show that the consequent sea-level rise associated with greenhouse gas (GHG) emissions from U.S. on-road vehicles is *de minimis* - that is, too small to matter. Included in the final rule is a "Technical Memo on: Temperature, CO2 Concentration, and Sea Level Rise Impacts of Greenhouse Gas Emissions from U.S. Motor Vehicles for the "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act" Final Rule[2] (henceforth referred to as "EPA Technical Memo"). The EPA Technical Memo provides details on the modeling done, including data tables giving their results. EPA's estimated reduction in global mean sea-level rise (GMSLR), assuming emissions associated with all U.S. on-road vehicles are removed beginning in 2027, is 1.4 cm over the 2027-2100 time period, with a 95% credible interval of 0.39-4.77 cm. The EPA modeling chain used the Building Blocks for Relevant Ice and Climate Knowledge (BRICK) sea-level model[3], of which I am one of the two original lead authors. I continue to manage the development of BRICK.

Here, I examine the baseline SSP2-4.5 GHG emissions scenario and several reduced emissions scenarios mirroring the cases in the EPA Technical Memo. I connect the temperature and ocean heat changes resulting from these scenarios to global mean sea-level rise, and subsequently to local mean sea-level rise (LMSLR) for the United States coastline. These projections can facilitate more targeted evaluations of the economic impacts to the United States associated with reduced GHG emissions from U.S. on-road vehicles. Further, there are a

number of modeling choices in the EPA Technical Memo that I seek to clarify and make transparent in the work presented here.

- First: GMSLR and GMST were used instead of local hazards. As these are global means, they may differ from the actual hazards faced by the United States' coasts. Here, I downscale the GMSLR from BRICK to LMSLR for the U.S. coasts. I also aggregate over the U.S. Gulf of Mexico Coast to capture a region more geographically homogeneous.
- Second: It is not clear which version of the BRICK model was used. Given the timing of the EPA Final Rule and accompanying Technical Memo (February 2026), and an interest in reproducing the EPA's general methods for purposes of understanding the Agency's analysis, I employ a model version of BRICK that was released in February 2025; the next model version was released in December 2025.
- Third: It is not clear which version of calibrated BRICK model parameters were used. Again, given the timing of the EPA modeling work, I employ a set of BRICK model parameters that were released alongside the model version noted above. Other structural choices for the model version and calibrated parameters are possible, and reasonable. The choices I made here are in an effort to reproduce the EPA modeling chain as accurately as possible based on the details provided in the EPA Technical Memo. I note that the Technical Memo does not include any supplemental files such as the computer codes used to perform the analysis. This standard scientific practice of providing underlying data and code builds and maintains trust in the scientific enterprise.
- Fourth: The EPA Technical Memo treats the combined FaIR-BRICK simulations as equally likely (p. 4). The models were calibrated separately, then combined, so the simulations constitute samples from a probability distribution that is distinct from the true FaIR-BRICK joint posterior distribution. Specifically, the FaIR parameters are sampled from their marginal posterior distribution, as are the BRICK parameters. I use a model weighting approach to reweight the FaIR-BRICK simulations according to how well they match observational data and account for the differences in sampling distributions.
- Fifth: Due to the multi-century scale of the sea-level response to GHG emissions and consequent global warming[4–7] , a longer simulation period than through the year 2100 is warranted. Here, I use a simulation period through the year 2200 to more fully capture the sea-level response to reduced GHG emissions from U.S. on-road vehicles.

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2 Modeling Workflow

2.1 Sea Level Modeling

I use the MImiBRICK[8] v1.2.0 implementation of BRICK, along with associated sets of calibrated parameters for BRICK[9]. MimiBRICK is an implementation of the BRICK sea-level model in Julia, in the Mimi integrated modeling framework[10]. MimiBRICK v1.2.0 is a model tag released in February 2025, while the following tag (v1.2.1) was released in December 2025. The MimiBRICK Zenodo repository contains several calibrated parameter sets, corresponding to multiple model configurations. The specific parameters file used in this work is "parameters_subsample_brick.csv", which was generated by calibrating BRICK in a "standalone" format, forced by a single trajectory of global mean surface temperature (GMST) and ocean heat uptake. Based on the modeling details provided in the EPA Technical Memo, this is my best guess at the BRICK configuration used by EPA.

In order to replicate the modeling workflow as closely as possible, based on the details provided in the EPA Technical Memo, I use input for GMST and ocean heat uptake from the Finite Amplitude Impulse Response climate model[11,12] (FaIR; version v2.2.0), using SSP2-4.5 radiative

forcing and GHG emissions and a set of 841 calibrated parameters (v1.4.1)[13]. FaIR is an open-source, reduced-complexity climate model, designed for probabilistic projections of global temperature and atmospheric GHG concentrations from emissions.

In addition to the baseline SSP2-4.5 scenario, which mirrors scenario #1 in the EPA Technical Memo, three additional scenarios are produced. Scenario A here reconstructs scenario #2 in the EPA modeling and captures EPA's projected level of on-road vehicle emissions in the United States, absent GHG regulations. Emissions trajectories under scenario A interpolate the sparse data points provided in the EPA Technical Memo (2027, 2050, and 2100) and hold emissions constant after the year 2055. Scenario B here represents a case in which U.S. vehicle technology stays at model year 2025 levels (the most recent year with reported data) and rates of adoption of electric vehicles remain constant, but total vehicle emissions evolve through changes in vehicle miles traveled. Scenario C here represents a counterfactual scenario without modern vehicle GHG regulations, fixing emissions rates at circa 2009 levels with no electric vehicle adoption and allowing total emissions to grow with increasing vehicle use.

In this way, scenarios B and C represent "today's fleet" and a "pre-GHG protection fleet", respectively, while scenario A mirrors the EPA Technical Memo scenario #2. Echoing the EPA Technical Memo and Final Rule, I note that this approach models removing all emissions associated with U.S. on-road vehicles, such that the projections presented in the EPA Technical Memo and here constitute in some sense an upper bound on the reductions in sea-level rise as a result of any specific set of GHG standards. However, the assumption of SSP2-4.5 as the baseline scenario neglects the fact that this "middle of the road" or "maintain current policy" scenario relies on actually maintaining the decarbonization efforts that were underway a decade ago when the Shared Socioeconomic Pathways were developed[14,15]. These factors will have compensatory effects.

For each of the 841 emissions trajectories, the global mean surface temperature and ocean heat uptake model output from FaIR serves as input to BRICK. Output from BRICK includes global mean sea-level rise, and the contributions to GMSLR from the Greenland and Antarctic ice sheets, glaciers, thermal expansion, and land water storage. To facilitate reproducibility, I set random number seeds and save the indices of the BRICK ensemble members sampled from the larger dataset of 10,000 calibrated parameter sets. However, due to insufficient details provided to exactly replicate the experimental set-up from the EPA Technical Memo, it is not expected that emissions trajectories or the resulting projections of global temperatures or sea levels will precisely match those presented in the Technical Memo.

2.2 Model Calibration

The BRICK model parameters in the dataset noted above were calibrated based on the model-data match to observational datasets for the major components of global mean sea-level change: the Greenland and Antarctic ice sheets, glaciers, thermal expansion, and land water storage. The Bayesian model calibration algorithm used is described in detail elsewhere[3,16,17], and the resulting distributions for sea-level projections are consistent with the Intergovernmental Panel on Climate Change's Sixth Assessment Report (IPCC AR6)[18]. Importantly, BRICK contains a simple module to account for potential "low confidence" but high-impact Antarctic ice sheet processes that can contribute substantially to sea-level change in the coming centuries[16]. Thus, projections using BRICK are expected to fall on the higher side of probable ranges for sea-level rise for the latter half of the 21st century and beyond, particularly for higher GHG emissions scenarios. In SSP2-4.5, these fast dynamical contributions to sea level from the Antarctic ice sheet can occur by the year 2100[16].

The parameter datasets that EPA used for FaIR and BRICK were calibrated independently of one another, then combined to form paired (concomitant) parameter sets for a coupled FaIR-BRICK model, wherein temperatures and ocean heat uptake output from FaIR serves as input to BRICK. The EPA Technical Memo asserts that all parameter sets and resulting simulations are equally likely. From a model calibration and statistical modeling standpoint, this is not the case because the BRICK simulations were calibrated using different temperature and ocean heat input than that from FaIR. On the other hand, the simulations in the ensemble constructed here are intended to be samples produced from the joint distribution of FaIR-BRICK parameters.

As an example, a set of FaIR parameters that yields a warm simulation for temperature could be paired with a set of BRICK parameters that yields a low simulation for sea-level rise. This should be treated as having relatively lower probability than more compatible sets of FaIR and BRICK parameters. To account for the variation in the goodness-of-fit of the combined FaIR-BRICK parameters, I compute weights for each concomitant parameter set and resulting simulation and use these weights to compute weighted percentiles for resulting ensemble statistics (e.g., for global mean sea-level change).

$$log(w_i) = c \cdot (l(\theta_{i,FB}) - l(\theta_{i,B})) \quad (1)$$

In Equation 1, $\theta_{i,B}$ refers to the i-th set of BRICK model parameters and $\theta_{i,FB}$ refers to the i-th set of FaIR-BRICK parameters (so the BRICK parameters are the same for both). In turn, $l(\theta_{i,B})$ refers to the value of the log-likelihood function when the BRICK model is run using its original temperature and ocean heat forcing and the i-th set of BRICK model parameters, and $l(\theta_{i,FB})$ refers to the log-likelihood value when the combined FaIR-BRICK model is run using the combined i-th set of FaIR-BRICK parameters. In Equation 1, c is a constant that is tuned to balance the influence of the best-fitting simulations against sampling from the full breadth of the approximate joint distribution of FaIR-BRICK simulations. The computed weights use a value for this “annealing” constant of c=0.000128. This yields an effective sample size of about 420, or roughly 50% of the original sample size. This is in line with guidelines and typical practice for importance sampling methods[19,20], where samples from one distribution are desired (e.g., the distribution of FaIR-BRICK parameters) but inaccessible, so they are approximated using samples from an easier-to-sample distribution (e.g., the marginal distributions of FaIR and BRICK parameters). Only the sea-level portion of the likelihood function is used because all 841 sets of FaIR parameters are known *a priori* to be well-calibrated to climate data; the BRICK parameters were calibrated to sea-level data, but the quality of the simulation is affected by changing the underlying temperature and ocean heat forcing data.

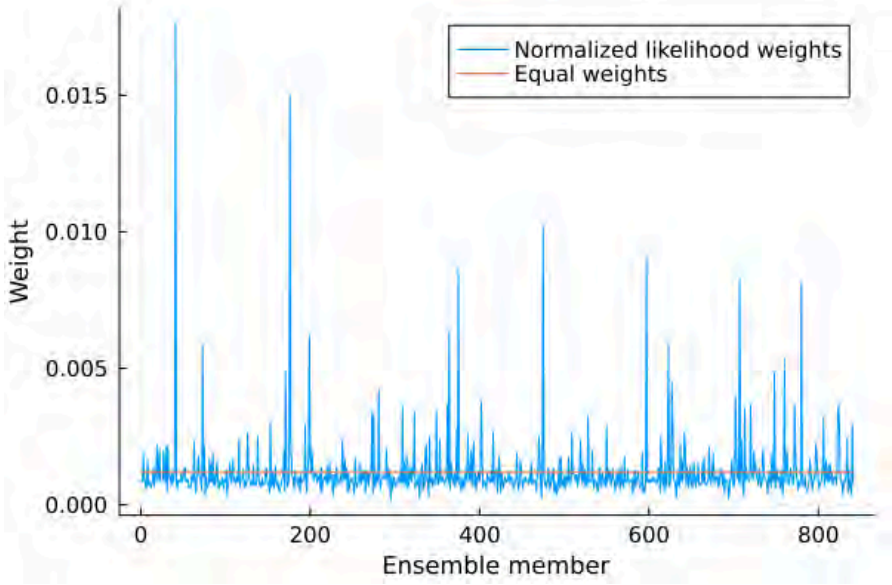
The log-weights from Equation 1 are then shifted by subtracting the maximum weight (to center them closer to 0 and avoid undue influence from the best-fitting simulations) and exponentiated to compute the unnormalized simulation weights, as shown in Equation 2.

$$W_i = exp[log(w_i) - max(log(w_i))] \quad (2)$$

Normalized weights are obtained by dividing by the sum, as shown in Equation 3.

$$W_{i,norm} = W_i / \sum_{i=1}^{841} W_i \quad (3)$$

Figure 1: Computed weights for each FaIR-BRICK simulation, based on the BRICK log-likelihood function. The dashed red line corresponds to equal weights of 1/841 ≈ 0.0012.



2.3 Local Hazards

The EPA Final Rule and Technical Memo use changes in GMST and GMSL as the measure of the impact of rescinding the vehicle emissions standards in the Clean Air Act. I use the BRICK sea-level output to estimate the associated local sea-level changes for the United States, which is better connected to the actual consequences to the U.S. of the policy change. In the case of sea-level rise, this is because local mean sea-level change can differ from global mean sea-level change due to differences in vertical land motion, ocean dynamics, and gravity effects from redistributing large amounts of ice/water[21].

I select two model simulations to downscale to local mean sea level. The first model simulation is the one with the highest normalized weight (Equation 3). I refer to this simulation the “MLE” simulation, as a maximum likelihood estimator is an approximate interpretation of how it was selected. I caution however that other simulations among the FaIR-BRICK ensemble also provide high-quality fits to the BRICK sea level calibration data, based on the model weights (Figure 1). The second model simulation that I downscale to local sea-level rise is the one that yields the median GMSLR in the year 2100 under the baseline scenario. These two simulations provide a reasonable representation of likely future local sea level rise for the United States coastline.

To compute the local mean sea-level rise (LMSLR) in the four scenarios described above, for each of the two model simulations chosen, I downscale the components of global mean sea-level change in each case to their effects on local mean sea level on a 1-degree latitude-longitude grid, using a set of well-established sea level fingerprints[22]. I compute the LMSLR for each of the 1,077 United States coastal segments from a common coastal database[23], over the 2010-2200 time horizon. To examine a specific geographic region with more similar properties, I also aggregate the localized sea-level rise over the 178 coastal segments of the United States Gulf of Mexico Coast.

3 Results

Where parenthetical uncertainty ranges are reported in the results, they are 95% credible intervals.

3.1 Global mean sea level

Results for global mean sea-level change relative to pre-industrial mean (1850-1900) are broadly consistent with those reported in the EPA Technical Memo in the baseline case (Table 1). In 2050, I find GMSLR of about 27.2 (18.4-53.6) cm, as compared to 38.9 cm reported in the EPA Technical Memo (relative to 1850-1900 mean). By 2100, GMSLR in the baseline case yields about 91.3 (42.5-179.4) cm, as compared to 94.3 (59.9-157.9) cm by the EPA's modeling. As expected, scenarios A, B, and C all match the baseline scenario in 2009, and scenarios A and B match the baseline case in 2027.

Table 1: Global mean sea-level rise relative to pre-industrial mean (1850-1900), by scenario. Shown are the ensemble projected median and 95% credible interval (cm), weighted as described in Sec. 2.2.

	Baseline	**Scenario A**	**Scenario B**	**Scenario C**
2009	10.1 (6.0-15.3)	10.1 (6.0-15.3)	10.1 (6.0-15.3)	10.1 (6.0-15.3)
2027	15.6 (10.6-22.5)	15.6 (10.6-22.5)	15.6 (10.6-22.5)	15.5 (10.5-22.5)
2050	27.2 (18.4-53.6)	27.0 (18.4-53.5)	27.0 (18.4-53.5)	26.8 (18.3-52.2)
2100	91.3 (42.5-179.4)	89.7 (42.0-176.5)	89.5 (41.9-176.3)	87.5 (41.4-174.2)
2150	177.9 (68.6-330.0)	174.7 (67.2-324.9)	174.3 (66.9-323.8)	170.5 (65.7-318.5)
2200	268.5 (95.6-475.1)	260.4 (90.5-467.6)	259.1 (89.8-464.9)	252.6 (87.5-456.1)

Results for global mean sea-level change relative to 2027 (the first year of assumed emissions reductions) also agree well in the baseline scenario and scenario A, relative to the EPA Technical Memo (Table 2). By 2050, I find 11.4 (6.0-32.7) cm of GMSLR in the baseline case, as compared to 12.4 (9.4-20.3) cm in the EPA Technical Memo. By 2100, this GMSLR reaches 76.1 (29.9-160.7) in this work, and 69.5 (35.2-132.7) cm in the EPA modeling. The reduction in GMSLR in scenario A relative to the baseline case is 0.07 (0.04-1.04) cm in 2050 and 1.45 (0.40-5.16) cm in 2100, compared to the reductions of 0.09 (0.06-1.06) cm in 2050 and 1.40 (0.39-4.77) cm in 2100. Over the 22nd century, these benefits in terms of reduced GMSLR increase to 3.61 (1.16-12.73) cm and 6.39 (2.35-21.18) cm in 2150 and 2200, respectively, in scenario A, and 4.28 (1.43-17.32) cm and 8.32 (3.12-29.34) cm in 2150 and 2200 in scenario B.

Table 2: Global mean sea-level rise relative to 2027, by scenario. Shown are the ensemble projected median and 95% credible interval (cm), weighted as described in Sec. 2.2.

	2027 Baseline	**Scenario A**	**Scenario B**
2050	11.4 (6.0-32.7)	0.07 (0.04-1.04)	0.07 (0.04-1.03)
2100	76.1 (29.9-160.7)	1.45 (0.40-5.16)	1.61 (0.44-5.82)
2150	163.6 (55.4-309.3)	3.61 (1.16-12.73)	4.28 (1.43-17.32)
2200	253.8 (82.1-454.1)	6.39 (2.35-21.18)	8.32 (3.12-29.34)

In (counterfactual) scenario C, reductions in GMSLR relative to baseline would reach 0.04 (0.03-0.08) cm by 2027, 0.29 (0.15-2.23) cm by 2050, 3.57 (0.91-9.65) cm by 2100, and 14.4 (5.17-60.3) cm by 2200 (Table 3).

Table 3: Global mean sea-level rise relative to 2009, for the baseline scenario and scenario C. Shown are the ensemble projected median and 95% credible interval (cm), weighted as described in Sec. 2.2.

	2009 Baseline	**Scenario C**
2027	5.5 (2.5-9.3)	0.04 (0.03-0.08)
2050	17.0 (9.6-41.0)	0.29 (0.15-2.23)
2100	81.0 (33.3-169.0)	3.57 (0.91-9.65)
2150	167.8 (59.0-317.4)	8.25 (2.58-30.40)
2200	260.5 (85.6-463.4)	14.37 (5.17-60.30)

3.2 Local mean sea level

I compute the local mean sea-level rise for all U.S. coastal segments within the DIVA database[23]. This dataset divides the global coastline into 12,148 segments with a median length of about 17 km. Since the coastlines of the United States show variation in major drivers of risk (e.g., east versus west coasts of the continental U.S., also, Alaska, Hawai'i, and various U.S. outlying territories), I specifically examine the mean local sea-level change along the U.S. Gulf of Mexico Coast ("Gulf Coast"). For ease of visualization and interpretation, I only downscale the FaIR-BRICK ensemble members yielding the maximum likelihood weight ("MLE") and the median GMSLR in the baseline case in the year 2100 ("Med2100"). These two simulations both are reasonable structural choices for a single "best-fitting" representative model simulation and well-represent a likely range of anticipated uncertainty around the ensemble centers. I note that GMSLR was downscaled to local sea-level rise on a 10-year time step to match the dataset used to account for non-climatic factors affecting local sea levels[24–26]. Consequently, results in Table 4 are shown relative to the year 2030 instead of 2027 as in the EPA Technical Memo and Table 2.

Table 4: Baseline GMSLR and LMSLR for the U.S. Gulf of Mexico Coast (cm), shown relative to 2030 for consistency with how downscaling was done, which used a 10-year timestep. Gulf Coast baseline is the mean local mean sea level for all 178 US Gulf of Mexico coastal segments, relative to 2030, in each of the two downscaled simulations, MLE and Med2100. Scenarios A, B, and C are given as the reduction in LMSLR relative to the Gulf Coast baseline scenario.

	GMSLR relative to 2030		**Gulf Coast baseline**		**Scenario A**		**Scenario B**		**Scenario C**	
	MLE	Med2100	MLE	Med2100	MLE	Med2100	MLE	Med2100	MLE	Med2100
2050	11.2	8.76	12	12	0.1	0.1	0	0.1	0.2	0.2
2100	47.4	78.3	53	92	2.8	3.7	2.8	3.8	3.4	6.5
2150	106.2	164.3	121	190	12.5	4.8	15.1	5.1	20.9	8.7
2200	181.7	249.7	205	286	20.1	6.2	26.5	7.3	55.5	12.1

The tendency of the Gulf of Mexico to experience higher LMSLR than GMSLR is evidenced by both the MLE and Med2100 simulations (Table 4, first 4 columns). The MLE simulation has slightly higher LMSLR than GMSLR in 2050 relative to 2030 (12 cm locally versus 11.2 globally). This difference grows to over 5 cm by 2100 and more than 20 cm by 2200. The Med2100 simulation displays an even higher rate of local sea-level rise compared to GMSLR. In the Med2100 simulation, by 2050, the Gulf Coast experiences more than 3 cm higher sea-level rise than global mean. By 2100, this difference increases to more than 13 cm and by 2200, more than 30 cm higher LMSLR than GMSLR in the Med2100 simulation. While land subsidence is responsible for much of the comparatively higher LMSLR for the Gulf Coast, the relative contributions from the major ice sheets, Greenland and Antarctica, also play a key role. Specifically, due to gravitational effects from melting large amounts of ice, contributions to GMSLR from the Greenland ice sheet serve to lower local mean sea level along the Gulf Coast, whereas contributions from the Antarctic ice sheet raise local mean sea level there. Since the Med2100 simulation sees a much higher sea level contribution from the Antarctic ice sheet, LMSLR is also relatively higher compared to the MLE simulation.

Also owing to the relatively larger sea level contribution from the Antarctic ice sheet, the Med2100 simulation shows lower reductions in LMSLR in the three reduced emissions scenarios when compared to the MLE simulation (Table 4, right 6 columns). Reductions in LMSLR for the Gulf Coast in scenario A for the two simulations considered here span 2.8-3.7 cm in 2100 to 6.2-20.1 cm by 2200. This exceeds the median reduction in GMSLR of 1.4 cm by 2100 reported in the EPA Technical Memo, indicating that local benefits for the U.S. Gulf Coast can be substantially larger than those suggested by global mean values alone. Scenario B yields similar reductions in 2100 (2.8-3.8 cm of reduced LMSLR) but larger benefits by 2200 (7.3-26.5 cm). Scenario C shows even greater and earlier reductions in LMSLR, with 0.2 cm in 2050, 3.4-6.5 cm by 2100, and 12.1-55.5 cm by 2200.

4 Discussion

I have implemented a modeling workflow that mirrors the sea-level projections workflow presented in the EPA Technical Memo as closely as possible given the details provided, while also improving the modeling workflow by taking into account variation in the quality of ensemble members through a weighting approach. I find projections of GMSLR that are broadly consistent with the projections as presented in the EPA Technical Memo, particularly for GMSLR by 2100 in the baseline scenario and in the reduced emissions scenario A. By downscaling the GMSLR projections to LMSLR for the entire U.S. coastline and the U.S. Gulf of Mexico Coast, I connect these sea-level projections to local coastal hazards more specific to the United States. These LMSLR projections, particularly for scenario A relative to the baseline scenario, demonstrate that vehicle emissions reductions via the Clean Air Act disproportionately benefit the U.S. Gulf Coast (Table 4).

For global mean sea level, the difference between the baseline SSP2-4.5 scenario and scenario A (EPA's scenario #2) is modest in the near-term, but grows over time, reflecting the long timescale of the sea-level response to changing emissions and temperature. By 2100, removing U.S. on-road vehicle emissions yields a median reduction of about 1.45 cm of GMSLR, but this effect more than quadruples to over 6 cm by 2200 (Table 2). Scenarios B and C also produce greater GMSLR reductions by 2100, and by the year 2200, these benefits grow to over 8 cm in scenario B and over 14 cm in scenario C (Tables 2 and 3). These results highlight the importance of considering the long-term consequences of continued emissions, even at marginal GHG levels that may seem too low to matter.

In the downscaling to local coastal hazards, for ease of interpretation, I use just two model simulations among the 841-member ensemble to characterize uncertainty. These are the simulation with the maximum likelihood weight among the ensemble (MLE) and the simulation yielding the median GMSLR in the year 2100 in the baseline scenario (Med2100). Both simulations were chosen based on their match to central tendency in the ensemble. Consequently, they may well underestimate the true breadth of potential future LMSLR for the U.S. Gulf Coast, even though the uncertainty ranges in Table 4 are substantial (represented by the range between the MLE and Med2100 simulations). Indeed, the sizable uncertainties associated with human decision-making, climate mitigation, and adaptation are given as reasons for the EPA Final Rule to avoid estimating actual economic benefits or on-the-ground impacts from reduced greenhouse gas emissions. However, previous work has demonstrated, for example in the case of managing coastal risk in New Orleans, Louisiana, that in the face of climate change, the most expensive strategy we can pursue is to do nothing[27].

5 Code and Data Availability

All model and analysis code, input, and output files are available at https://zenodo.org/records/19577321. Figures and tables from this work may be reused or adapted with permission from the author.

6 Acknowledgments

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7 References

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Exhibit D

April 16, 2026

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RE: Petition for reconsideration of "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act," 91 Fed. Reg. 7686 (Feb. 18, 2026); Docket EPA-HQ-OAR-2025-0194

Service Employees International Union petitions for reconsideration of EPA's final rule titled "Rescission of the Greenhouse Gas Endangerment Finding and Motor Vehicle Greenhouse Gas Emission Standards Under the Clean Air Act," 91 Fed. Reg. 7686 (Feb. 18, 2026) (the "Rule"). SEIU submits this petition under section 307(d)(7)(B) of the Clean Air Act, 42 U.S.C. § 7607(d)(7)(B), and the Administrative Procedure Act, 5 U.S.C. § 553(e).

SEIU is a 501(c)(5) labor organization that represents approximately 2 million members. The general purpose of SEIU is to safeguard and advance workers' welfare and to improve working

conditions for its members. SEIU's organizational mission includes protecting the health and welfare of service workers in its membership, including by seeking reductions in the emissions of climate-altering pollutants. In particular, SEIU members include service workers whose work outdoors makes them particularly vulnerable to environmental harms. SEIU thus has a history of advocating to protect workers from the impacts of climate change and other environmental harms.

SEIU adopts, and incorporates by reference, the arguments in the petitions for reconsideration of the Rule submitted by the Commonwealth of Massachusetts, et al., on April 1, 2026; by the Zero Emission Transportation Association on April 14, 2026; and by the Environmental Defense Fund, et al., on April 15, 2026 (by email) and on April 16, 2026 (by mail). The Clean Air Act requires EPA to grant reconsideration of the issues presented in these petitions because the issues were not available for public comment and because the issues are of central relevance to the outcome of the Rule. SEIU does not, however, concede that an administrative petition for reconsideration is necessary for SEIU or other parties to challenge EPA's failure to comply with notice-and-comment requirements in judicial petitions for review of the Rule.

I. The Rule relies on new methodologies, inputs, and assumptions that were not available for public comment.

EPA published the proposal for the Rule on August 1, 2025. 90 Fed. Reg. 36,288 (Aug. 1, 2025). EPA proposed to rescind EPA's 2009 endangerment finding, 74 Fed. Reg. 66,496 (Dec. 15, 2009), and to repeal all greenhouse-gas emission standards for light-duty, medium-duty, and heavy-duty motor vehicles and engines.

The proposal relied on a draft report from a group of climate change deniers called the "Climate Working Group." The draft report attempted to cast doubt on well-established climate science. EPA relied on the draft report throughout the proposal, including to support EPA's proposed conclusion that regulating greenhouse-gas emissions under section 202(a) of the Clean Air Act would be futile. 90 Fed. Reg. at 36,305.

Following the proposal, a federal district court held that the Climate Working Group had been established in violation of the Federal Advisory Committee Act. *Envt'l Def. Fund. v. Wright*, No. 1:25-cv-12249-WGY, 2026 WL 251626 (D. Mass. Jan. 30, 2026).

In the final Rule, EPA disclaimed its reliance on the Climate Working Group report. 91 Fed. Reg. at 7691 n.8. Instead, EPA substituted previously undisclosed modeling to support the Rule's futility rationale. EPA used four models—known as OMEGA, MOVES, FaIR, and BRICK—to project the impacts of U.S. motor-vehicle greenhouse-gas emissions on global mean surface temperature (GMST) and global sea level rise (GSLR). *Id.* at 7728–33. EPA concluded that such impacts would be de minimis, and EPA concluded that regulation under section 202(a)(1) would be futile. EPA also relied on these findings as support for the other purportedly independent grounds in the Rule. *E.g.*, *id.* at 7710–12, 7716–17, 7724.

EPA did not previously disclose these new methodologies, the inputs and underlying assumptions, or the conclusions that EPA drew based on applying the new methodologies. Accordingly, commenters never had a chance to weigh in.

II. EPA must reconsider the Rule under section 307(d)(7)(B).

Under section 307(d)(7)(B) of the Clean Air Act, EPA must grant a petition for reconsideration if the petition shows that:

> (1) it was "impracticable" to raise an objection during the public comment period or if the grounds for such objection "arose after" the public comment period but within the time specified for judicial review, and
>
> (2) that objection is of "central relevance to the outcome of the rule."

42 U.S.C. § 7607(d)(7)(B). In response to a reconsideration petition under that provision, EPA must "provide the same procedural rights as would have been afforded had the information been available at the time the rule was proposed." *Id.*

The Rule relies on new methodologies, inputs, and assumptions that EPA did not disclose in time for public comment. Because EPA did not provide "adequate notice" in the proposal, *Clean Air Council v. Pruitt*, 862 F.3d 1, 10 (D.C. Cir. 2017), it was "impracticable" for commenters to object to those undisclosed methodologies, inputs, and assumptions and the conclusions that EPA drew from them, 42 U.S.C. § 7607(d)(7)(B). The grounds for those objections also "arose after" the public comment period but within the time specified for judicial review. *Id.*

The previously undisclosed material is of "central relevance" to the Rule. *Id.* Not only did EPA rely on the new methodologies to support its futility rationale, but EPA also relied on them for other purportedly independent grounds for the Rule. EPA relied on its new futility analysis to support its statutory interpretation, 91 Fed. Reg. at 7710–12, 7716–17, and its application of the major questions doctrine, *id.* at 7724. An objection to the undisclosed new methodologies thus provides "substantial support for the argument that the regulation should be revised," making it of central relevance. *Chesapeake Climate Action Network v. EPA*, 952 F.3d 310, 322 (D.C. Cir. 2020).

* * *

For the above reasons—and the reasons stated in the reconsideration petitions submitted by the Commonwealth of Massachusetts, et al., the Zero Emission Transportation Association, and the Environmental Defense Fund, et al.—EPA should grant these petitions for reconsideration, reopen public comment, and reconsider the Rule.

Respectfully submitted,

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